from A. H. Allen

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NEW

AMERICAN FARM BOOK.

ORIGINALLY BY

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REVISED AND ENLARGED BY

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PREFACE.

THIS work was originally written by RICHARD L. ALLEN, then one of the editors of the "American Agriculturist." It was published in the year 1846, the first and only complete work of kindred character in this country, down to that time. It was an able compilation of valuable matter, some portions of it then existing in various miscellaneous publications of the day, crystalized, and brought into available shape, through the industry of its experienced author.

The volume—then among the best agricultural books of the day, and upon subjects less investigated and studied than now—had a wide circulation, and met with general approval by those competent to judge of the topics on which it treated. It was a work of ability, of laborious research, and study; but, like similar books in a rapidly progressive age, has had its day. Twenty-three years is a long time for any book, treating on science, and improved practice—particularly as applied to agriculture—to have a successful

sale and still meet the popular demand, on a great proportion of the subjects of its discussion.

The publishers, aware of the continuous demand for works advancing sound views on the treatment of the varied subjects which this volume embraces, and the original author being engaged in pursuits more responsible, and important to himself, placed it in the hands of the undersigned for revision, amendment and extension, so far as might be necessary. Much of the original matter, incapable of improvement, has been left as originally written. New discoveries, and subjects not before well comprehended have been added, giving the present enlargement, and wider compass to the work.

In its present shape it comprises all that can well be condensed into an available volume of its kind. Nothing in fact, short of an Encyclopedia of Agriculture, would embrace in full, all the subjects, in the various extended ramifications necessary to their treatment. The topics are therefore discussed in a manner partly suggestive, although sufficiently instructive to guide the practical farmer in the treatment of the various matters embraced, taking a fair view of their importance.

The prominent value, and dignity of Agriculture is more than ever appreciated by the American people. It ranks fairly among the learned professions. Its importance is acknowledged by the NATION in its Congressional capacity by the aids it has extended to its improvement; by the several STATES of the Union in

their Legislative encouragement; and by the PEOPLE at large through the increased attention they bestow on its implements, economies, labors, and results. The public PRESS, widely potential over opinion in what relates to the welfare of the people, exhibits its regard for the farmer in devoting a share of its weekly columns to the discussion of his interests, while the AGRICULTURAL MONTHLIES and WEEKLIES of the day, firmly established in their indispensable importance, send forth their hundreds of thousands of copies to enlighten the mass of our population in this, the fundamental source of national wealth, prosperity, and greatness.

Fifty years ago a *stable* agricultural periodical did not exist on the American continent. Fitful publications now and then glimmered out through the general darkness. The profession of the Farmer was without official recognition, his calling laborious, and his elevation to the higher responsibilities of government, science, literature, professional life, and art, attainable only with great difficulty, chiefly on account of the hard-working life he was obliged to lead, which was the principal obstacle to his attaining a fair education. To-day great attention is given to agricultural education, especially to such as will both fit farmers for their especial calling and for taking positions of the greatest influence in society: labor-saving implements relieve them of that exhausting bodily labor which so unfits man for intellectual exertion, and throughout

our land every avenue to social and political distinction is as fully open to farmers as to any of our citizens. Besides, when our great men, and those who have been successful in professional or mercantile pursuits, have secured a competency, or amassed fortunes, they generally retire to the farm, and there, as practical workers, or indulging in amateur fancies, find rest and enjoyment. Among such persons, no doubt a great number of the readers of this volume will be found. Their needs have been had in mind by the editor while writing primarily for the guidance and instruction of the professional farmer, who has constant need of a book of reference.

LEWIS F. ALLEN.

BUFFALO, N. Y., 1869.

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AMERICAN AGRICULTURE.

INTRODUCTION.

Agriculture, in its most extensive sense, may be defined—the cultivation of the earth with a reference to the production of vegetables, and the conversion of portions of them into animals and a variety of forms which are the best adapted to the wants of mankind. It is appropriately distinguished by numerous subdivisions.

Tillage Husbandry consists in the raising of grain, roots and other products, which require the extensive use of the plow and harrow to prepare the ground for annual sowing and planting.

Grazing is limited to the pasturing and winter feeding of farm stock, and it requires that the land appropriated to this purpose, should be kept in pasturage for summer food, and in meadows to yield the hay necessary for winter's use. In its strictly technical meaning, grazing implies the rearing of farm stock till they have attained sufficient maturity for a profitable market, as far as this maturity can be secured on grass and hay. It, however, properly embraces in its minor divisions, the keeping of cows for the purposes of a dairy, and the support of flocks for the production of wool.

Feeding, in its agricultural signification, consists in stall fattening animals, and it is properly connected with tillage husbandry, by which grain and roots are produced, and by their free use, animals can be brought to a higher condition or *ripeness*, and

they will thus command a much better price in market, than if fed exclusively on grass and hay.

Breeding, technically defined, is restricted to the production of choice animals for use as future propagators, by the judicious selection and crossing of the best specimens of the various distinct breeds of domestic stock.

Horticulture embraces the entire department of gardening and fruit culture.

Aboriculture, the cultivation of trees and shrubbery.

By *Planting*, (or the occupation of planters,) is understood the cultivation of extensive farms or plantations, for the exclusive production of one or more commercial staples; as cotton, sugar, rice, tobacco, indigo, etc., and their preparation for a distant market. The term is peculiarly sectional, and its use, so far as adopted in this country, is limited to the Southern part of it.

The foregoing, and various other occupations connected with the cultivation of the earth, are comprehended under the general head of Agriculture.

Besides the varied practical knowledge which is indispensable to the proper management of every department of Agriculture, its general principles and theoretical relations require a familiarity with the elements of History, Geology, Meteorology, Entomology, Zoölogy, Chemistry, Botany, Anatomy, Animal and Vegetable Physiology, and Mechanics, involving a wide share of human knowledge and science.

In view of its intricacy, its magnitude, and its importance to the human race, we cannot fail to be struck with the peculiar wisdom of Deity in assigning to man this occupation, when a far seeing and vigorous intellect fitted him to scan with unerring certainty and precision, the visible works of his Creator, and

trace their causes and effects through all their varied relations. It was while in the sinless perfection of his original nature, when "the Lord God put him into the garden of Eden, to dress it and to keep it," and agriculture was his sole occupation, that his god-like intelligence enabled him, instinctively, to give appropriate names, indicative of their true nature or character, "to all cattle, and to the fowl of the air, and to every beast of the field;" and so just and accurate was his perception, that "whatsoever he called every living creature, that was the name thereof."

In our present imperfect condition, a beneficent Providence has not reserved a moderate success in Agriculture, exclusively to the exercise of a high degree of intelligence. His laws have been so kindly framed, that the hand even of uninstructed toil, may receive some requital in remunerating harvests; while their utmost fullness can be anticipated, only where corporeal efforts are directed by the highest intelligence.

The indispensable necessity of an advanced agriculture to the comforts and wealth, and indeed, to the very existence of a great nation, renders it an object peculiarly worthy the attention and regard of the legislative power. In looking to the history both of ancient and modern times, we find, that wherever a people have risen to enduring eminence, they have sedulously encouraged and protected this right arm of their strength. Examples need not be given, for they abound in every page of their civil polity.

Our own country has not been wanting in a moderate regard for Agriculture. By wise legislation in our National Congress, every item of extensive agricultural production within the United States, with the single exception of the inferior wools, is believed to be now protected from foreign competition, by an unyielding and

perfectly adequate impost on all such articles, as would otherwise enter into a successful rivalry with them from abroad. Many of our subordinate, or State Legislatures have also, by liberal provisions, given such encouragement to various objects, as they deemed necessary to develop the agricultural resources within their jurisdiction. Such have been the appropriations for numerous Geological and other State surveys; the bounties on different articles, as silk, hemp, and some others; and occasionally a small gratuity to encourage the formation and support of State and County Agricultural Societies.

The organization of a "Department of Agriculture" at Washington a few years ago, by our National Congress, has been a step in the right direction for the acceleration of our progress in all that appertains to this indispensable branch of American industry. It has powers and means, if efficiently directed, to embrace and disseminate throughout the land all the information available for the purposes of the husbandman.

So far as relates to obtaining rare and valuable plants and seeds, and other agricultural material, from every quarter of the globe, and their distribution to all parts of the country suitable to their growth and production; to report from time to time the statistics of crops, their cultivation and production, comparative or otherwise; and to give to the public all such information as may be in its power, to the various interests of the country, either commercial, manufacturing, or agricultural, which may inure to their benefit, it only needs a wise administration in this Department to confer unbounded benefits on the agriculture of our country. This was a favorite, yet never a fully digested plan of Washington, the promptings of whose benev-

olent and comprehensive mind were never followed but for his country's good.

From wise action of the individual States, a less commanding, but not less beneficial duty is required. Restrictions wisely imposed upon the General Government, limit its action to such measures only as are essential to the general welfare, and such as cannot properly be accomplished by any more circumscribed authority. More liberal and enlarged grants from the people, as their well-tried and intelligently ascertained wants may be developed, give to the State Legislatures the power of doing all which their constituents choose to have effected for their own benefit.

Education, in all its branches, is under their exclusive control; and to endow and foster every institution which has a tendency to raise and improve the intellectual, the moral and the social condition of the people, has ever been their cherished policy. Yet, up to this time, no institution expressly designed for the professional education of farmers, has ever been perfected in this country. That far seeing wisdom which characterizes the consummate statesman, which regards the future equally with the present and past, has at last culminated in a most benificent act of our National Congress, by a liberal provision in the donation of public lands, for the partial endowment of agricultural schools in the several States. To aid with every means in their power in laying the foundations broad and deep, to elevate the superstructures, to rear the mighty columns, and adorn the graceful capitals, would seem most properly to come entirely within the province of the representatives of intelligent freemen, the great business of whose lives is the practice of agriculture.

In addition to continuing and making more general and comprehensive the encouragement for these objects heretofore considered, it is the duty of each and every State of the Union liberally to endow and organize its Agricultural College, and insure its successful operation within its jurisdiction. Connected with these should be example and experimental farms, where the suggestions of science should be amply tested and carried out before submitting them to the public. The most competent men at home and abroad should be invited to fill a professional chair; and if money would tempt the most accomplished professional talent to leave the investigations of European soils and products, and devote their minds and energies to the development of American Husbandry, it should be freely given. In the absence of the latter, we must seek and build them up from native growth.

These institutions should be schools for the teachers equally with the taught; and their liberally appointed laboratories and collections should contain every available means for the discovery of what is yet hidden, as well as for the further development of what is already partially known. Minor institutions should of course be established at different and remote points, to scatter the elements of agricultural knowledge broadcast over the land, and bring them within the reach of the poorest citizens and the humblest capacities.

By such a liberal and enlightened course, we should not only incalculably augment the productive agricultural energies of our own country, but we should also in part repay to the world at large the obligations under which we now rest, for having appropriated numerous and important discoveries and improvements from abroad. If we have the ability, which none can doubt, we

should make it a point of honor to return in kind, the liberal advances we have thus received.

It is to the rising generation these suggestions are made, the risen are but partially prepared for their acceptance. A great majority of the latter have been educated, and become habituated to different and more partial influences. By their industry, intelligence, and energy displayed in numberless ways, and especially by their protection of American labor, they have accomplished much for their own and their country's welfare—with but partially accomplished efforts, they will leave this glory for their successors.

AMERICAN AGRICULTURE.

CHAPTER I.

SOILS.

Soils are those portions of the earth's surface which contain a mixture of mineral and vegetable, or animal substances, in such proportions as adapt them to the support of vegetation. Rocks are the original basis of all soils, which by the convulsions of nature, or the less violent but long continued and equally efficient action of air, moisture and frost, have been broken into fragments more or less minute. There are various gradations of these changes.

The Texture of Soils.—Some soils embrace large bowlders or rounded stones, that thickly overspread the surface and mingle themselves with the earth beneath it, giving to it the name of a rocky soil. The equal prevalence of the same materials, but of smaller sizes, give to the surface where they abound, the character of a stony soil. A third and more minute division is called a gravelly soil; a fourth is a sandy soil; a fifth constitutes a loam; and a sixth, in which the particles of earth are of a different character, is popularly denominated a clay soil. The two first mentioned, are not properly distinct soils, as the only support of any profitable vegetation is to be found in the finer earth in which the rocks and stones are embedded. In frequent instances, they materially benefit the crops, in the influence produced by the warmth, moisture, and protection from winds, afforded by them; and by the gradual decomposition of such as contain

lime, potash and other fertilizing materials, they contribute to the support of the soil. This last effect is aided by the apparently worthless vegetable life which they yield to the living mosses that cling to their sides and everywhere penetrate their fissures, thus imperceptibly corroding the solid structures and preparing them for future usefulness as soils. If we add to the above, a peat or a vegetable soil, we shall have the material divisions of soils, as distinguished by their texture.

OTHER CLASSIFICATION OF SOILS.—Soils are also distinguished by their tendency to absorb and retain water, gravel and sand holding very little, while clay and peat readily absorb and retain a great deal; by their constant saturation from perennial springs, which are called springy soils; by the quantity of vegetable and animal matter they contain; by their porosity or adhesiveness; by their chemical character, whether silicious, argillaceous or calcareous; by the quality and nature of the vegetation they sustain; and lastly, and by far the most important, they are distinguished by their fertility or barrenness, the result of the proper adjustment and combination of most of the conditions enumerated. Deserts of sands, layers of rocks, stone or pure gravel, and beds of marl and peat, are not soils, though containing many of their most important elements.

It is apparent to the most casual observer, that soils frequently, and by almost imperceptible degrees, change from one character to another, and that no classification therefore, however minute, will suffice to distinguish each. Some obvious, yet simple distinctions, which are usually recognized, must nevertheless be assumed for future reference. For this purpose, and to avoid unnecessary deviations from what should be a common standard, we shall adopt the arrangements as made by Professor Johnston, which is based principally upon their chemical constituents.

"1st. *Pure clay* (pipe-clay,) consisting of about 60 of silica and 40 of alumina and oxide of iron, for the *most part* chemically combined. It allows no silicious sand to subside when diffused through water, and rarely forms any extent of soil.

"2d. *Strongest clay soil* (tile-clay, unctuous clay) consists of pure clay mixed with 5 to 15 per cent. of a silicious sand, which can be separated from it by boiling and decantation.

"3d. *Clay loam* differs from a clay soil, in allowing from 15 to 30 per cent. of fine sand to be separated from it by washing, as above described. By this admixture of sand, its parts are mechanically separated, and hence its freer and more friable nature.

"4th. A *loamy soil* deposits from 30 to 60 per cent. of sand by mechanical washing.

"5th. A *sandy loam* leaves from 60 to 90 per cent. of sand, and

"6th. A *sandy soil* contains no more than 10 per cent. of pure clay.

"The mode of examining, with the view of naming soils, as above, is very simple. It is only necessary to spread a weighed quantity of the soil in a thin layer upon writing paper, and, to dry it for an hour or two in an oven or upon a hot plate, the heat of which is not sufficient to discolor the paper—the loss of weight gives the water it contained. While this is drying, a second weighed portion may be boiled or otherwise thoroughly incorporated with water, and the whole then poured into a vessel, in which the heavy sandy parts are allowed to subside until the fine clay is beginning to settle also. This point must be carefully watched, the liquid then poured off, the sand collected, dried as before upon paper, aud again weighed. This weight is the quantity of sand in the known weight of *moist* soil, which by the previous experiment has been found to contain a certain quantity of water.

"Thus, suppose two portions, each 200 grs., are weighed, and the one in the oven loses 50 grs. of water, and the other leaves 60 grs. of sand,—then, the 200 grs. of *moist* are equal to 150 of *dry*, and this 150 of dry soil contain 60 of sand, or 40 in 100 (40 per cent.) It would, therefore, be properly called a *loam*, or *loamy* soil.

"But the above classification has reference only to the clay and sand, while we know that lime is an important constituent of soils, of which they are seldom entirely destitute. We have, therefore,

"7th. *Marly soils*, in which the proportion of lime is more than 5 but does not exceed 20 per cent. of the whole weight of the dry soil. The marl is a sandy, loamy, or clay marl, according as the proportion of clay it contains would place it under the one or the other denomination, supposing it to be entirely free from lime, or not to contain more than 5 per cent., and

"8th. *Calcareous soils*, in which the lime exceeding 20 per cent. becomes the distinguishing constituent. These are also calcareous clays, calcareous loams, or calcareous sand, according to the proportion of clay and sand which are present in them.

"The determination of the lime also, when it exceeds 5 per cent., is attended with no difficulty.

"To 100 grs. of the dry soil diffused through half a pint of cold water, add half a wine glassful of muriatic acid, (the spirit of salt of the shops,) stir it occasionally during the day, and let it stand over night to settle. Pour off the clear liquor in the morning and fill up the vessel with water, to wash away the excess of acid. When the water is again clear, pour it off, dry the soil and weigh it—the loss will amount generally to about one per cent. more than the quantity of lime present. The result will be sufficiently near, however, for the purposes of classification. If the loss exceed 5 grs. from 100 of the dry soil, it may be classed among the marls; if more than 20 grs., among the calcareous soils.

"Lastly, vegetable matter is sometimes the characteristic of a soil, which gives rise to a further division of

"9th. *Vegetable molds*, which are of various kinds, from the garden mold, which contains from 5 to 10 per cent., to the peaty soil, in which the organic matter may amount to 60 or 70. These soils also are clayey, loamy, or sandy, according to the predominant character of the earthy admixtures

"The method of determining the amount of vegetable matter for the purposes of classification, is to dry the soil well in an oven, and weigh it; then to heat it to dull redness over a lamp or a bright fire till the combustible matter is burned away. The loss on again weighing is the quantity of organic matter."

The foregoing are only such general divisions as possess properties sufficiently common to each, to require a treatment nearly similar. Besides their principal component parts, every soil must contain in greater or less quantities, all the elements which enter into the composition of vegetables. They may have certain substances which are not necessary to vegetable life, and some one or all of such as are, may be contained in excess; yet to sustain a healthy prolific vegetation, they must hold, and in a form fitted to its support, silex, alumina, carbonate of lime, sulphate of lime, potash, soda, magnesia, sulphur, phosphorus, manganese, oxide of iron, chlorine, and probably iodine. These are called the inorganic, or earthy parts of soils, as they are almost exclusively found in combination with earths, salts, or minerals. They, however, constitute from less than 0.5 (one-half of one) to over 10 per cent. of all vegetables. In addition to these, fertile soils must also contain carbon, oxygen, nitrogen and hydrogen, which are called the organic parts of soils, from their great preponderance in vegetables and animals, of which they constitute from about 90, to over 99 per cent. of their entire substance.

Clay Soils—Their Characteristics and Treatment.—Clay soils are usually denominated cold and wet, from their strong affinity to water, which they generally hold in too great excess for rapid or luxuriant vegetation. The alumina which exists in clay, not only combines with water, forming a chemical compound, but the minute division of its particles and their consequent compactness, oppose serious obstacles to the escape of such as rests in or upon it. Hence the necessity of placing it in a condition to obviate these essential defects.

The most effectual method of disposing of the surplus water in clay soils, is by underdraining. This draws off rapidly, yet by

imperceptible degrees, all the excess of water, and opens it to the free admission of atmospheric air; and this, in its passage through the soil, imparts heat and such of the gases it contains, as are useful in sustaining vegetation. When under-drains are wanting, open drains should be formed wherever water stands after rains; the slight elevation and depression of the surface made by careful plowing, will probably be sufficient, if they terminate in some ravine or artificial ditch, and have size and declivity enough to pass off the water rapidly.

Clay soils are greatly improved by coarse vegetable manures, straw, corn stalks, chips, etc., which tend to the separation of its particles. The addition of sand is very beneficial, but this is too expensive for large fields. Lime is also a valuable material for a clay soil, as by the chemical combinations which are thereby induced, the extreme tenacity of the soil is broken up, while the lime adds an ingredient of fertility, not before possessed by it perhaps, to an adequate extent. Gypsum has the same effect in a more powerful degree. Paring and burning (by which the surface containing vegetable matter is collected into heaps and fired, reducing the mass to a charred heap, which is again spread over and mixed with the soil,) produced the same result. This is a practice which has been long in use in different parts of Europe, and although attended with immediate and powerful results, it is too expensive for general introduction into a country where labor is high, and land and its products comparatively cheap.

The plowing of clay lands for spring crops should be done in the autumn if practicable, by which their adhesiveness is temporarily destroyed, the earth is finely pulverized by the frost, and they are left in the finest condition for early spring sowing, and without additional working. If plowed in the spring, it should be done when they are neither too wet or dry; if the former, the earth subsequently bakes, and for a long time it is almost impenetrable to the hoe or the teeth of the harrow; if too dry, they are so compact as to be turned over only with great effort, and

then in solid lumps. The action of the atmosphere will pulverize these masses of baked earth after a time, but not sufficiently early for the convenience or advantage of such crops as are intended immediately to follow the plowing.

No soils are so tenacious of the manures which may be incorporated with them as the clays. They form an intimate combination, both mechanical and chemical,* and hold them securely against waste from drainage or evaporation for an indefinite time, till the growing crops demand them. They also greedily seize upon and hoard up all such fertilizing principles as are conveyed to them by the air and rains. We may mention as an example of their efficiency in abstracting vegetable nutrition from the atmosphere, that many of them when thrown up from a great depth below the surface, and entirely destitute of organic remains, (vegetable or animal matter,) after an exposure for some months to its meliorating influence, become capable of bearing large crops without the aid of manure. This is particularly true of the clays which rest on the Onondaga limestone, an extensive group occupying the central and north-western part of New York.

The clays are admirably adapted to the production of most of the grains and of the red and white clovers cultivated in the United States. These they yield in great profusion, and of the best quality; and so peculiarly suited are they to meadows and pas-

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* By *mechanical*, in the sense above used, is understood the external relation of bodies, which is nearly equivalent in its meaning in this connection, to artificial. Thus the clay envelops the manures, and from its impervious nature, it shields it from escape either by drainage or evaporation, and almost as effectually as if it were enclosed in an earthen vessel.

By *chemical*, is meant its internal or constitutional character. Thus clay not only absorbs the gases which are brought into contact with it from manures, from moisture, and from air, as a sponge absorbs water, but it also forms new combinations with them, which change the original nature of these elementary principles, and from light evanescent gases, they become component parts of solid bodies, in which condition they are retained till exhausted by the growing vegetation.

These terms are important, and should be clearly understood. For the sake of aiding the young student, we will give some further examples. If we take a piece of crystalized marble, compact uncrystalized limestone, and chalk, we shall have three substances exactly alike in their *chemical* character; for they are all combinations of carbonic acid and lime associated together in precisely the same proportions. But

turage, that they are styled by way of eminence, *grass lands.* They are justly characterised as strong and lasting soils, and when properly managed and put to their appropriate use, they are esteemed as among the choicest of the farmer's acres.

SANDY SOILS AND THEIR MANAGEMENT.—The character and treatment of sandy soils, are in almost every particular the reverse of those of clay. They do not possess the property of adhesiveness, and they have but little affinity for water, which escapes from them almost as soon as it falls. They have but a slight hold upon the manures which are diffused through them; they are loose in their texture, and may be plowed at any time with equal advantage, provided the sowing or planting is to follow immediately.

As clay soils are much benefitted by a mixture of sand, so likewise are sandy soils greatly improved by the addition of clay, yet in a much higher degree; for though it would never pay, as a general rule, to add sand to clay, yet the addition of a few loads of the stiffest clay to a light sand, would in almost every instance much more than compensate for the trouble and expense. For this purpose, the clay should be thinly spread in autumn upon sward land previously plowed, and the winter's frost will effectually separate the particles. It should then be harrowed thoroughly and deeply in the spring, and subsequently plowed if necessary.

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in their external arrangements, as they appear in a recent fracture to the eye and touch, that is, in their *mechanical* arrangements, they are all totally dissimilar.

Again, if we take the pure lime (quick lime) that is obtained from each of the foregoing by subjecting them to an intense heat, by which the carbonic acid is expelled, and pour upon it nearly one-third of its weight in water, great heat is developed and the lime both mechanically absorbs, and chemically combines with it, forming a new compound, or salt, which is a hydrate of lime.

If sand (mostly silex) be added to the lime with water, and *mechanically* mixed or stirred together and allowed to remain for a sufficient time, they will combine *chemically*, forming a portion of silicate of lime, (an ingredient of old mortars.)

Sand (silex) stirred in with clay, (an impure alumina) is *mechanically* mixed; if then subject to a strong heat as in making brick, they become *chemically* united, forming silicate of alumina, inseparable by any human means short of the chemist's crucible. If we divide or separate a stick by splitting or cutting, it is a mechanical; and if by burning or charring, it is a chemical change. Thus every alteration, either in nature or art, is referable to one of the above conditions or changes.

Such a dressing on a light, crawling land, is more than equivalent to an equal quantity of the best manure, and will be permanent in its effects. Clay and sand are necessary to each other, as they both contain qualities which are essential to a good soil; and that will always be found the best, which has the proper proportion of each.

Sandy soils are improved by the frequent use of a heavy roller; it cannot be used too often. They require to be made more compact, and any treatment that secures this object, will be advantageous.

Lime, by its chemical action on the constituents of soils, while it separates clay, renders sand more adhesive; and when cheaply obtained, it is always a profitable dressing for sandy soils, to the full amount they may require. Gypsum, in considerable quantities, has an effect similar to lime, both on clay and sand; and when added in smaller portions, produces a striking increase in the crops of sandy soils. Clay marls, containing either carbonate, sulphate, or phospate of lime, are of great value to sandy soils. Equally beneficial are ashes, leached or unleached, peat, or vegetable manures of any kind. Some calcareous sands, containing a large proportion of lime, like those of Egypt and extensive regions in the Barbary States, will produce luxuriantly, if supplied with a slight addition of manure and an abundance of water. Sandy soils can never be profitably cultivated till they have acquired sufficient compactness and fertility to sustain a good growth of grass or clover; and when once brought to this condition, they are among the most valuable.

They are at all times easily plowed and worked; they require no draining; and though light and dry, are quick and kindly soils, giving an immediate and full return for the labor and manure bestowed upon them. When in a condition to produce grass, sheep are admirably adapted to preserve and augment their fertility, and by their incessant migrations over it, their sharp hoofs pack the surface closely, producing the same effect as the roller.

Gravelly Soils, are in some respects similar to sand, but much less desirable, being appropriately termed *hungry*. They

are also like the latter, peculiarly leachy, but in an increased degree, permitting the rapid escape of manures, both by evaporation and drainage. Such as are calcareous or composed of limestone pebbles, are in a great measure not subject to those objections; as the disposing affinities of the lime (of which enough will be found to exist in the soil in a finely comminuted or divided state, which in this condition is enabled to act efficiently,) have a tendency to retain the vegetable matters, thus compacting the soil, and holding whatever pabulum, or food of plants, may from time to time be given to it for the wants of future crops. Unless of this latter description, gravelly soils should not be subjected to tillage; but appropriated to pasturage, when sheep will keep them in the best and most profitable condition of which they are capable.

LOAMY SOILS, being intermediate between clay and sand, possess characteristics and require a treatment approximating to one or the other, according to the predominance of either quality. They are among the most desirable soils for the various purposes of agriculture.

MARLY AND CALCAREOUS SOILS, have always a full supply of lime, and like the loams, they frequently incline towards a clay or sand, requiring a treatment corresponding to their character. Putrescent and vegetable manures increase their fertility, and they are held with great tenacity till exhausted by crops. In durability or lastingness they cannot be exceeded.

ALLUVIAL SOILS, are such as have been formed from the washing of streams. They vary in their characteristics, from a mixed clay to an almost pure sand; but generally they combine the components of soils in such proportions as are designated by *loamy soils* or *sandy loams.* When thus formed they are exceedingly fertile, and if subject to the annual overflow of a stream, having its sources far above them, they usually receive such an addition to their productiveness, as enables them to yield large crops perpetually without further manuring.

They are for the most part easily worked, and are suited to the various purposes of tillage and meadows; but when exposed

to overflowing, it is safer to keep them in grass, as this crop is less liable to injury by a freshet; and where subject to washing from the same cause, a well matted sod is the best protection which can be offered against it. Many of the natural grasses which come into these meadows yield a fodder of the highest value.

PEATY SOILS, are composed almost wholly of peat, and are frequently called vegetable soils. They are extensively diffused between the latitudes of 42° and 60° north, at a level with the ocean, and are frequently found in much lower latitudes, wher the elevation of the surface produces a corresponding temperature. They generally occupy low, swampy levels, but sometimes exist on slight northern declivities, where the water in its descent is arrested by a succession of basin shaped cavities.

Their peaty character is acquired by the growth and partial decay through successive ages, of various aquatic plants, the principal being the sphagnums and lichens. In swamps, many of which were probably small lakes in their origin, the peat is found of unknown depth, reaching in some instances beyond thirty and forty feet. On declivities and occasional levels, the peat is sometimes only a few inches in thickness. It is of a blackish or dark brown color, and exists in various stages of decay, from the almost perfect state of fallen stumps and leaves, to an imperfectly defined, ligneous mass, or even an impalpable powder.

In its natural state, it is totally unfit for any profitable vegetation, being saturated with water of an antiseptic nature, which effectually resists putrefaction or decay. When thrown out of its native bed and exposed to drain for a few months, much of it is fit for fuel; and it is always of advantage to the muck heaps, as an absorbent of the liquid and gaseous portions of animal and other volatile manures; or it is of great utility when applied alone to a dry, gravelly or sandy soil.

Cultivation of Peat Soils.—When it is desirable to cultivate a peat soil, the first process is to drain it effectually of all the moisture which has given to it, and sustained, its present character

The drains must be made sufficiently near, and on every side of it; and so deep as to prevent any injurious capillary attraction of the water to the surface. When it has been properly drained, the hummocks, if any, must be cut up with the mattock or spade and thrown into heaps, and burnt after they are sufficiently dried, and the ashes scattered over the surface. These afford the best top dressing it can receive. Sand or fine gravel, with a thorough dressing of barn-yard manure and effete lime, should then be added. On some of these, according as their composition approaches to ordinary soils, good crops of oats, corn, roots, etc., may be grown, but they are better suited to meadows, and when thus prepared, they will yield great burthens of clover, timothy, red top, and such of the other grasses as are adapted to moist soils. Subsequent dressings of sand, lime, manure, and wood ashes, or of all combined, may be afterwards required when the crops are deficient, or the grasses degenerate.

Peat contains a large proportion of carbon, and the silicates in which such soils are deficient, and which they procure only in small proportions from the farm-yard manures, but more largely from the sand or gravel, are essential to furnish an adequate coating for cornstalks, straw and the valuable grasses. As they are exhausted they must be again supplied, or the crops will fail. Besides yielding an important food to the crop, lime is essential to produce decomposition in the mass of vegetable matter, as well as to combine with and aid in furnishing to the growing plants, such of their food as the atmosphere contains. Ashes are one of the best applications, as they possess the silicates, lime, potash, and other inorganic materials of plants in great abundance, and in a form readily adapted to vegetable nutrition. Gypsum is also a valuable manure for peaty soils.

SUBSOILS AND THEIR MANAGEMENT

The efficiency of soils for producing good crops, depends much on the subsoil. If this consists of impervious clay or hard-pan, so as to oppose a ready escape to the water, it is evident the

accumulation of the heavy rains will materially injure the vegetation above them; for it is certain that while nothing is more essential to productive crops than an adequate supply of moisture to the roots, nothing is more injurious than their immersion in stagnant water. When such is the character of the subsoil, it should be under-drained if possible, or if this be not practicable, it should be broken and loosened by the use of the subsoil plow.

A variety of plows have been constructed for this purpose, but unless it be intended to deepen the soil by an admixture of manures, care should be taken to avoid bringing up the subsoil to mix with that on the surface. In addition to the more ready escape of water thus secured by breaking it up, the air is also admitted, which enables the roots to strike deeper, and draw their nourishment from a much greater depth. The increased distance through which the roots penetrate, furnishes them with additional moisture during a season of drought, thereby securing a luxuriant crop when it might otherwise be destroyed. This is frequently a great item in the profit of a farmer; as besides the increase of crop which follows a dry hot season when a full supply of moisture is furnished, the product is usually of better quality; and the general deficiency of agricultural produce which ensues from seasons of drought, makes his own more valuable.

As a result of this practice, there is also a gradual increase in the depth of the soil, as the fine and more soluble particles of the richer materials above are constantly working down and enriching the loosened earth below; and in time this becomes good soil, which in proportion to its depth, increases the area from which the roots derive their nutriment. So manifest are the advantages which have followed the use of subsoil plows, that they have been extensively introduced of late years among the indispensable tools of the better class of agriculturists.

When the subsoil is loose and leachy, consisting of an excess of sand or gravel, thereby allowing the too ready escape of moisture and the soluble portions of manures, the subsoil plow is not only unnecessary, but positively injurious. In this case, the surface soil should be somewhat deepened by the addition of vegetable ma-

nures, so as to afford a greater depth, through which they must settle before they can get beyond the reach of the roots; and the supply of moisture is thereby much augmented. It is better however, to keep lands of this character in wood, or permanent pasture. They are at best, ungrateful soils, and make a poor return for the labor and manure bestowed upon them.

If there be a diversity in the character of the sub and surface soil—one being inclined to sand and gravel, and the other to marl or clay—a great improvement will be secured by allowing the plow to reach so far down as to bring up and incorporate with the soil, some of the ingredients in which it is wanting. This admixture is also of remarkable benefit in old or long cultivated soils, which have become deficient in inorganic matters and in their texture.

The effect of long continued cultivation, besides exhausting what is essential to the earthy part of plants, is to break down the coarser particles of the soil, by the mechanical action of the plow, harrow, etc., and in a much more rapid degree, by the chemical combinations which cultivation and manuring produce. A few years suffice to exhibit striking examples in the formation and decomposition of rocks and stones. Stalactites and various specimens of limestone, indurated clays, sandstone, and breccias or pudding stones, are formed in favorable circumstances, almost under our eye; while some limestones, shales; sandstones, etc., break down in large masses annually, from the combined effect of moisture, heat and frost. The same changes on a smaller scale, are constantly going forward in the soil, and much more rapidly while under cultivation. The general tendency of these surface changes is towards pulverization. The particles forming the soil, from the impalbable mite of dust, to the large pebbles, and even stones and rocks, are continually broken up by the combined action of the vital roots and the constituents of soils, by which new elements of vegetable food are developed and become available, and in a form so minute, as to be imbibed by the spongioles of the roots, and by the absorbent vessels, they are afterwards distributed in their appropriate places in the plant. Where this action has

been going on for a long period, a manifestly beneficial effect has immediately followed from bringing up and mixing with the superficial earth, portions of the subsoil which have never before been subject to cultivation.

A subsoil which is permeable to water, is sometimes imperceptibly beneficial to vegetation, not only by allowing the latent moisture to ascend and yield a necessary supply to the plants, but a moisture frequently charged with lime and various saline matters, which the capillary attraction brings from remote depths below the surface. It is probably from this cause, that some soils produce crops far beyond the yield which might be reasonably looked for from the fertilizing materials actually contained in them. This operation is rapidly going forward during the heat of summer. The water thus charged with saline matters ascends and evaporates at and below the surface, leaving them diffused throughout the soil. After long continued dry weather, a thin white coating of these salts is frequently discernible on the ground.

Where rain seldom or never falls, this result is noticeable in numerous and sometimes extensive beds of quiescent (not shifting) sand. Deposits ofttimes occur several inches in thickness. Such are the extensive beds of impure muriate of soda and other salts in the arid deserts of Arizona; in the great Salt Lake Basin; in the southern parts of Oregon; the nitrates found in India, Egypt, Peru, and various other parts of the world.

ADDITIONAL PROPERTIES OF SOILS.

Besides the qualities of soils already noticed, there are several physical conditions which affect their value. They should be of sufficient depth, friable, or easily pulverized; they should possess the right color, and be susceptible of the proper admission and escape of heat, air, and moisture.

Jethro Tull, who wrote more than a century ago on the subject of agriculture, maintained that if a soil be worked to a proper depth, and perfectly well pulverized, nothing more is necessary to insure an indefinite succession of the most luxuriant crops without

the aid of manures; and it must be confessed his practice gave some apparently strong confirmations of his theory. By carrying tillage far below the surface, thus securing the minute division of the earth, and rendering it permeable to the roots, he insured the free access of air and moisture, which are among the first and most important requisites in the growth of vegetables.

But Tull wrote before agriculture became a science, and omitted to estimate the large amount of fertile ingredients which every crop takes out of the soil, and which can only be supplied by the addition of fresh materials. A succession of crops would therefore, so far reduce the soil as to render it necessary to add manures, or vegetation must inevitably fail. This careful laborious practice could only for the time being, enhance the crop and prolong its available supplies; yet in accomplishing even this object, his example is worthy of the imitation of every tiller of the soil.

Friableness of the Soil, is a quality equally removed from the adhesiveness of strong clay, or the openness of loose sand. Good loams, and fertile alluvial soils, always possess this property. When stirred by the plow, the spade, or the hoe, the earth should fall and crumble readily, although wet. Such a condition secures a ready admission to the roots, which thus easily pervade the soil, and draw from it in every direction, their necessary support. Under draining and the addition of coarse manures to clay, fermented manures and ashes to sand, and lime and gypsum to both, will materially enhance their friableness.

Color is an essential feature in soils, and like friableness, it has an important relation to their capacity for heat and moisture. Dark colored earths, and black in the highest degree, absorb heat more rapidly than any other when exposed to a temperature above their own, and it escapes with equal readiness when their relative temperature is reversed.

A rough pulverized surface, which is seen in the minute inequalities of a friable soil, produces the same result. During the heat of the day, especially when the sun's rays fall upon the earth, the dark friable soil imbibes the heat freely, and transmits it to the

remotest roots, thus securing warmth to the plant, which is one of the necessary conditions of its growth. When the temperature of the air falls, on the approach of evening, a reversed action in the soil takes place by which the heat as rapidly escapes. This immediately brings the surface to "the dew point" and secures a copious deposit of moisture, which a friable soil speedily conveys to every part of the roots.

The dew point is attained when the surface of any object is below the temperature of the surrounding air; and the careful observer will not fail to discover the formation of dew, not only after the sun has risen, and long before he sinks below the horizon, when the condition above indicated exists; but sometimes even in the fervor of a mid-day sun, when the thick corn or any luxuriant vegetable growth repels his fierce rays from the earth. In many instances, the rank, dark growing crops themselves, when shielded from the sun's rays by their overspreading tops, become rapid condensers of atmospheric vapor, and the plant drinks in at every pore, the wholesome and nutritious aliment, and frequently collects a surplus, which streams down its sides to the thirsty soil beneath. The principle is further illustrated by the deposit of moisture in large globules on the surface of any vessel or object in the shade, which is sensibly below the surrounding temperature, as is shown by an earthen or metallic vessel filled with cold water and set in a warm room on a summer's day.

The proper capacity of soils for imbibing and parting with moisture, gives to some a decided advantage over others which have it in an imperfect degree; as it is found by recent experiments, that rich porous soils, which are readily penetrated by water and air, absorb the nutritious gases (oxygen, nitrogen, and their compounds, nitric and carbonic acid, ammonia, etc.,) largely from the atmosphere, and that they do this to an appreciable extent, only while moist. The effect of this will readily be estimated, from the well known beneficial influence exerted on the growing plant by the presence of these important elements.

Light colored clays, marls and sands, are neither in their mechanical texture, friableness or color, the best suited to promote the growth of plants. *Peat soils*, from their too great affinity for water in their natural condition, are even less adapted to the object than either of the preceding.

Schubler has found that during twelve hours in the night, when the air was moist, 1,000 lbs. of entirely dry quartz* or common sand, did not gain a pound; calcareous sand gained 2 lbs.; loamy soil, 21 lbs.; clay loam, 25 lbs.; such as were rich in vegetable mold, still more, while peats absorbed a much larger per cent. than either.

Davy also found, that the same quantity of very fertile and perfectly dry soil on exposure gained 18 lbs. in one hour; a good sandy soil under the same circumstances absorbed 11 lbs.; a coarse inferior sand, 8 lbs.; and an almost worthless heath gained but 3 lbs.

The power of soils in retaining water, is somewhat proportionate to their power of absorbing it:

				Of its own weight.	
Quartz sand	is saturated	when	it contains	24	per cent.
Calcareous sand	"	"	"	28	"
Loamy soil	"	"	"	38	"
Clay loam	"	"	"	47	"
Peat (about)	"	"	"	80	"

It is thus evident that perfection is not obtained in either sandy, gravelly, clay or peat soils, as they are characterized in the classification we have assumed. It is only when they have been improved by partial admixture with each other, and charged with the proper quantity of vegetable manures, and the salts which are requisite for their fertility; when they have been drained wherever necessary to free them from stagnant water, whether upon or

* Quartz, as analyzed by Bergmann, gave 93 per cent. of silex; 6 of alumina; and 1 of oxide of iron. It comes so near a pure silica, that in treating of it agriculturally, we speak of it as silex or silica.

within the soil, or to remove any noxious springs which sometimes contain matters in solution injurious to vegetation; and finally when the subsoil is in the proper condition to facilitate the free passage of the roots in every direction—it is only when all these conditions exist, that the fullest products from soils can be realized.

It is absolutely essential to profitable cultivation, that all the earthy substances required by the crops should exist in the soil in sufficient quantities, and in an accessible form to supply its wants. The proportions may be various, one sometimes greatly predominating over another, as is sufficiently obvious in the equally productive powers of good clays, sands and peats; yet in every instance it will be found, unless owing to a heavy coating of manures, and a peculiarly favorable season, that they can be relied on for such constant results, only when they have been so ameliorated as to approximate towards the character of loams.

The following is an analysis of three specimens of very fertile soils, made by Sprengel:

	Soil near Osterbruch.	From the banks of the Weser. near Hoya.	near Weserbe.
Silica, Quartz, Sand and Silicates,	84.510	71.849	83.318
Alumina,	6.435	9.350	3.085
Oxides of Iron,	2.395	5.410	5.840
Oxide of Manganese,	0.450	0.925	0.620
Lime,	0.740	0.987	0.720
Magnesia,	0.525	0.245	0.120
Potash and Soda extracted by water,	0.009	0.007	0.005
Phosphoric Acid,	0.120	0.131	0.065
Sulphuric Acid,	0.046	0.174	0.025
Chlorine in common Salt,	0.006	0.002	0,006
Humic Acid,	0.780	1.270	0.800
Insoluble Humus,	2.995	7.550	4.126
Organic matters containing nitrogen,	0.960	2.000	1.220
Water,	0.029	0.100	0.150
	100	100	100

The above had remained for a long time in pasture, and the second was remarkable for the fattening qualities of its grass, when fed to cattle.

The following are arable lands of great fertility:

	1	2		3
	Soil from Moravia.	From Ohio. Soil.	Subsoil.	Soil. From Belgium.
Silica and fine Sand, ...	77.209	87.143	94.261	64.517
Alumina, ...	8.514	5.666	1.376	4.810
Oxides of Iron, ...	6.592	2.220	2.336	8.316
Oxide of Manganese, ...	1.520	0.360	1.200	0.800
Lime, ...	0.927	0.564	0.243	Carb. of Lime. 9.403
Magnesia, ...	1.160	0.312	0.310	Carb. of Ma. 10.361
Potash chiefly combined with Silica,	0.140	0.120	0.240	0.100
Soda, ditto, ...	0.640	0.025	0.240	0.013
Phosphoric Acid combined with Lime and Oxide of Iron, ...	0.651	0.060	trace	1.221
Sulphuric Acid in Gypsum, . .	0.011	0.027	0.034	0.009
Chlorine in common Salt, . . .	0.010	0.036	trace	0.003
Carbonic Acid united to the Lime,	....	0.080	....	....
Humic Acid, ...	0.978	1.304	....	0.447
Insoluble Humus, ...	0.540	1.072	....	....
Organic substances containing nitrogen, ...	1.108	1.011	....	....
	100	100	100	100

"Of these soils, the first had been cropped for 160 years successively, without either manure or naked fallow. The second was a virgin soil, celebrated for its fertility. The third had been unmanured for twelve years, during the last nine of which it had been cropped with beans, barley, potatoes, winter barley and red clover, clover, winter barley, wheat, oats, naked fallow."—*Johnston.*

Bergmann found that one of the most fertile soils in Sweden contained 30 per cent. of carbonate of lime. Chaptal analyzed a very productive soil in France, which gave near 25 per cent. of the same, and 7 of organic matter. Tillet even found one, and that the most fertile, which yielded 37.5 of carbonate of lime. Some of the best in the Mississippi valley, have yielded upon analysis, 20 to 25 per cent. of magnesian lime, and of phosphate of lime, 2 to 3 per cent. Many other soils throughout the United States, contain an equal proportion of carbonate of lime. Such are usually the last to wear out, and the first to recover by the addition of manures, when suffered to remain uncultivated or in a state of rest.

CHAPTER II.

MANURES.

While soils are permitted to remain in their natural state, or if denuded of their original foliage and used only for pasture, little or no change is perceptible either in their character or productive powers. A slight change is however gradually wrought in their texture and capacity for production, which is fully revealed in the lapse of centuries. The elevated mountain's side, and the steep declivities of hills, support a vegetation of more or less luxuriance; and a portion of this, together with the broken twigs, and even the wasting matter of fallen trees, are carried down by the rains and become a rich addition to the lower soils on which they ultimately rest. Besides the vegetable matter thus annually removed from one spot and accumulated upon another, many of the fertilizing salts, which the action of the roots, or exposure to the atmosphere has rendered soluble, and the fine particles of earth which the alternations of heat and frost, of rain and drought, have reduced to dust, are also washed out of the higher soils and deposited on the plains and valleys below. Such, doubtless, was once the condition of those secondary bottom lands, which for ages probably, received the rich deposits from other soils, but whose present situations, elevated beyond even the extraordinary rise of the rivers whose course is near, show some radical alteration of their respective levels, by which the latter no longer contributes to their fertilization.

These soils being well stored with the food of plants, and frequently to a great depth, will bear large successive crops for a long period; and they have, in many instances, been treated by

their first occupants as if they were inexhaustible. Of this description were the James river and other alluvial lands in Virginia, some of which were continued in uninterrupted crops of corn and tobacco for more than a century without the addition of manures. But they have long since become exhausted, and the more careful planters are now endeavoring to resuscitate those worn out lands, which ought never to have become impoverished. Of the same character are most of the secondary bottoms on the Connecticut, the Scioto, the Miami, and other rivers. The first, although under cultivation for more than two centuries, in consequence of its division among intelligent farmers, has fully maintained its productiveness; and the latter, if properly managed, are capable of perpetual fertility. Although but a little more than half a century has elapsed since these last have been subject to the white man, they have already, in too many instances, been severely cropped. The writer has seen fields, which he was assured have borne sixty seven large successive crops of corn, and exclusively from their own resources. A more careful tillage is however becoming general.

The lower alluvial bottoms that are frequently overflowed, and thus receive large coatings of manures which are fully equivalent to the products taken off, are the only soils which will permanently sustain heavy crops without the aid of man. Such are the banks of the Nile and the Ganges, and many of our own rivers, which by the overflowing of their waters alone, have continued to yield large annual burthens, the two former, for more than 3,000 years; but they are thus supported at the expense of a natural drainage of thousands of acres, which by this means are proportionally impoverished. Manures then, in some form, must be considered as absolutely essential to sustaining soils subjected to tillage.

In their broadest sense, manures embrace every material, which if added to the soil, tends to its fertilization. They are appropriately divided into *organic and inorganic*; the first embracing animal and vegetable substances, which have an appreciable

quantity of nitrogen; the last comprehending only such as are purely mineral or earthy, and which in general contain no nitrogen. These characteristics are sometimes partially blended, but they are sufficiently distinct for classification.

Much pertinacity has been exhibited by some highly intelligent minds, who should have entertained more liberal views, as to the peculiar kinds of manures necessary to support a satisfactory productiveness. We have seen that Tull maintained, that the deepening and thorough pulverization of the soil was alone sufficient to secure perpetual fertility. But this crude notion, it is evident to the most superficial modern reader, is wholly untenable. Some agriculturists of the present day however, while they scout at the theory of Tull, (who was really a shrewd man for his day,) will yet claim as essential to successful vegetation, the existence in the soil of but a part only of the food of plants. Thus, one asserts that the salts alone will secure good crops; others maintain that the nitrogenous substances are the true source of fertility; while still another class refer to the presence of humus or geine (the available product of vegetable and animal decay in the soil) as the only valuable foundation of vegetable nutriment in all manures. Truth and sound practice lie between, or rather in the combination of all these opinions.

It has been shown in a preceding page, that all fertile soils must have not less than 15, and more probably 16, different simple or elementary substances, in various combinations with each other. All of the ordinary cultivated plants contain potash, soda, lime, magnesia, alumina, silica, oxide of iron, oxide of manganese, sulphuric acid, phosphoric acid, chlorine, and frequently iodine; each of which, excepting the two last, are in combination with ogygen. In addition to these, they also have carbon, oxygen, nitrogen and hydrogen. Other substances or ultimate principles may possibly exist in plants, which analysis may hereafter detect, but hitherto they have eluded the closest investigation.

It is therefore obvious that such principles as all fertile soils furnish to vegetables, must be contained in manures. It is no

satisfactory answer to this position to assert, that numerous experiments have apparently been successful, of growing plants in pure sand and water; or with charcoal and the salts added; or even that there are some atmospheric plants, that fulfill their zoophytic existence in air. Growth may continue for a long time under such circumstances; *but full maturity never arrives, and probably never can, without the available presence in the soil of every element which enters into the composition of plants.*

Profitable farming requires that manures embodying all these elements, should be added in sufficient quantities to the soil, to develop fully and rapidly, such crops as are sought from it. It becomes then, a matter of the highest consequence to the farmer to understand, not only what substances may be useful as manures but also how to apply them in the best manner to his crops so far as they can be made profitable. We shall first speak of the inorganic manures.

ASHES.

If any organic matter, whether animal or vegetable, be burnt, an incombustible substance remains behind, called the ash, or ashes. This varies in different plants from less than 1 to over 12 per cent. of their whole weight. It also varies with the different soils upon which they are found, with the different parts of the same plant, and in the different stages of its maturity. Thus plants which grow on peaty, or low, wet soils, give a less proportion of ashes, than those which mature upon soils that are dry or rich in the silicates and salts. The bark, leaves and twigs, give much more ashes than the trunks of trees and stems of plants: and in their early growth, they yield a larger proportion than after they have attained maturity.

The following table, constructed from several reliable sources, but principally by Sprengel, arranged in part by Johnston, will show the relative quantity of ashes found in some of the more important objects of cultivation:

	Potash.	Soda.	Lime.	Magnesia.	Alumina.	Silica.	Sulphuric Acid.	Phosphoric Acid.	Chlorine.	Oxide of Iron.	Oxide of Manganese.	Total in every 1,000 lbs.
*Wheat—Grain, .	2.25	2.40	0.96	0.90	0.26	4.00	0.50	0.40	0.10	trace		11.77
" Straw, .	0.20	0.29	2.40	0.32	0.90	28.70	0.37	1.70	0.30			35.18
Barley—Grain, . .	2.78	2.90	1.06	1.80	0.25	11.82	.59	2.10	0.19	trace		23.49
" Straw, .	1.80	0.48	5.54	0.76	1.46	38.56	1.18	1.60	0.70	0.14	0.20	52.42
Oats—Grain, . . .	1.50	1.32	0.86	0.67	0.14	19.76	0.35	0.70	0.10	0.40		25.80
" Straw, . .	8.70	0.02	1.52	0.22	0.06	45.88	0.79	0.12	0.05	0.02	0.02	57.40
Rye—Grain, . . .	5.32	†	1 22	0.44	0.24	1.64	0.23	0.46	0.09	0.42	0.34	10.40
" Straw, . .	0.32	0.11	1.78	0.12	0.25	22.97	1.70	0.51	0.17			27.93
Field Bean } Bean, . .	4.15	8.16	1.65	1.58	0.34	1.26	0.89	2.92	0.41			21.36
Field Bean } Straw, . .	16.56	0.50	6.24	2.09	0.10	2.20	0.34	2.26	0.80	0.07	0.05	31.21
Field Pea } Pea, . . .	8.10	7.39	0.58	1.36	0.20	4.10	0.53	1.90	0.38	0.10		24.64
Field Pea } Straw, . .	2.35		27.30	3.42	0.60	9.96	3.37	2.40	0.04	0.20	0.07	49.71
Potato—Roots, . .	4.028	2.334	.331	.324	.050	.084	.540	.401	.160	.032		8.284
" Tops, .	8.19	.09	12.97	1.70	.04	4.94	.42	1.97	.50	.02		30.84
Turnips—Roots, .	2.386	1.048	.752	.254	.036	.388	.801	.367	.239	.032		6.303
" Leaves,	3.23	2.22	6.20	.59	.03	1.28	2.52	.98	.87	.17		18.09
Carrots, ...	3.533	.922	.657	.384	.039	.137	.270	.514	.070	.033	.060	6.619
Parsnips, ...	2.079	.702	.468	.270	.024	1.62	.192	.100	.178	.005		4.180
Rye Grass, ...	8.81	3.94	7.34	0.90	0.31	27.72	3.53	0.25	0.06			52.86
Red Clover, ...	19.95	5.29	27.80	3.33	0.14	3.61	4.47	6.57	3.62			74.78
White Clover, . .	31.05	5.79	23.48	3.05	1.90	14.73	3.53	5.05	2.11	0.63		91.32
Lucern, ...	13.40	6.15	48.31	3.48	0.30	3.30	4.04	13.07	3.18	0.30		95.53
Sainfoin, ...	20.57	4.37	21.95	2.88	0.66	5.00	3.41	9.16	1.57			69.57

The farmer will perceive from this table, the great value of ashes to his crops. The quantity seems small in comparison with the total weight of the vegetables; yet small as it is, the aggregate of a few years will so far exhaust the soil of one or more of the principles necessary to sustain a luxuriant vegetation, that it will cease to yield remunerating returns. The annual exhaustion

*In the foregoing table, the grain, beans, peas, straw and hay are estimated after they have been dried in the air; the roots as they are taken from the field. The clovers and grass lose from 55 to 75 per cent. of their entire weight when full of sap, lessening, of course, as they approach to the state of ripening their seed. The potato loses in drying, 69 per cent. of water; the turnip, 91; carrot, 87; the turnip leaf, 86; the carrot leaf, parsnip and parsnip leaf, each 81; and the cabbage, 93.

There is much variation in the different specimens of the above substances subjected to examination, according to the peculiar variety, the different circumstances and various stages of their growth. The oat is the most variable of the grains, one specimen sometimes containing three times the quantity of ash afforded by others. The roots also sometimes vary as three to one in their quantity of ash. As the grain and most of the other crops approach to maturity, the quantity of some of the principles constituting the ash diminish, as of potash and soda, their presence being no longer necessary in the sap to aid the formation of the various products of the plants.

† Included in Potash.

of salts from large crops of grain, roots and grass, is from 180 to more than 250 lbs. in every acre of soil. The ashes of vegetables consist of such elements as are always required for their perfect maturity, and it is evident they must furnish one of the best manures which can be supplied for their growth. They are to the earthy parts of vegetables, what milk is to the animal system, or barn-yard manures are to the entire crop; they contain every element, and generally in the right proportions, for insuring a full and rapid growth.

Ashes then, may be pronounced the best of the saline manures. They are also among the most economical; as from our free use of fuel, they are largely produced by almost every household. Good husbandry dictates that not a pound of ashes should be wasted, but all should be saved and applied to the land; and where they can be procured at a reasonable price, they should be purchased for manure. Leached ashes, though less valuable, contain all the elements of the unleached, having been deprived only of a part of their potash and soda. They may be drilled into the soil with roots and grain, sown broadcast on meadows or pastures, or mixed with the muck heap. They improve all soils not already saturated with the principles which they contain.

The quantity of ashes that should be applied to the acre, must depend on the soil and crops cultivated. Potatoes, turnips and all roots—clover, lucern, peas, beans, and the grasses, are great exhausters of the salts, and they are consequently much benefited by ashes. They are used with decided advantage for the above crops in connection with bone dust; and for clover, peas and roots, their effects are much enhanced when mixed with gypsum. Light soils should have a smaller, and rich lands or clays, a heavier dressing. From twelve to fifteen bushels per acre for the former, and thirty for the latter, is not too much; or if they are leached, the quantity may be increased one-half, as they act with less energy. Repeated dressings of ashes, like those of lime and gypsum, without a corresponding addition of vegetable or barn-yard manures, will eventually exhaust tillage lands.

Ashes may be applied to meadow lands, for a longer time than to any other crops, and for this obvious reason. The whole surface of the soil is closely covered with vegetable agents, which are actively employed in drawing carbon from the air and soil, a large portion of which is stored up in the stubble and roots, which thus makes it less important that the organic matters should be given back to the soil, in the shape of vegetable or animal manures. As an instance of the rapidity with which this operation goes forward, it has been found that the dried roots and stubble of a clover field the second year, (and after one crop for the first, and two for the second season had been taken off,) yielded 56 lbs. for every 100 lbs. of the aggregate crops of hay. An old meadow has yielded 400 lbs. of roots for every 100 of hay for the season. Carbonaceous and organic matters are constantly increasing in pastures, and they also increase for a time in meadows; and will continue to do so for an indefinite period, if the ashes of plants are added to the soil nearly to the amount of those taken off. With this increase in the organic elements of vegetation, (if we were certain that nitrogen is accumulated in the same ratio, which we are not,) it is evident that the salts alone would then be wanting to give the utmost luxuriance. But care is necessary that they be not added in excess.

Coal Ashes.—The bituminous and anthracite coals afford ashes, and although inferior in quality to those made from wood and vegetables, are like them, a valuable manure, and they should be applied to the land in a similar manner. If they contain many cinders from not having been thoroughly burned, they are more suited to heavy than to light soils; as they tend to their mechanical division, which though beneficial to the former, is injurious to the latter.

Ashes of Sea Weeds or Marine Plants.—When from either quantity or remoteness it is inconvenient to carry the sea weed, which abounds on some coasts, on to the soil, it can be burned; when it will be found to yield a large proportion of ash, which is peculiarly rich in soda. This is of great value to the

farmer. Several species of the *fuci* have for a long period been collected and burned on the northern coasts of Scotland, Norway and the Baltic, formerly an article of commerce under the name of *kelp*. Its value consisted in its alkaline properties, for which it was much used by the glass and soap makers, the bleachers, and for other uses in the arts. For these purposes it is now nearly superceded by *soda ash*, a crude carbonate of soda, extracted by the decomposition of sea salt; and the price it now bears in market will bring it within the reach of farmers for some of the economical purposes of husbandry.

PEAT ASHES.—Nearly all peat approaching to purity, when thrown out of its bed and thoroughly dried, will admit of being burned to an imperfect ash; and when it does not reach this point it will become thoroughly charred and reduced to cinders. In both of these forms it is a valuable dressing for the soil. It is always better for dry uplands, to use the unburned peat after it has been properly composted in a muck heap, as the organic matters which it contains, and which are expelled by burning, are of great benefit to the soil. But when they are remote, the peat may be burned at a trifling cost, and the ashes carried to a considerable distance with manifest profit. The principal use hitherto made of them by farmers, has been in spreading them directly over the surface of the reclaimed bed from which they were taken.

LIME.

LIME is the product of limestone, marble, marl or chalk, after it has been burned, or subjected to an intense heat. In either of the foregoing forms it is a carbonate, and contains from 43 to 46 per cent. of its weight of carbonic acid, which is expelled by calcination. After the acid has been driven off, the lime is in its quick or caustic state, and in that condition its affinity for moisture and carbonic acid is great, and it greedily combines with both on ex-exposure to water, the earth, or even to the atmosphere, passing again into a carbonate and hydrate. It is in these latter conditions that it is applied to soils and muck heaps. If reduced to

powder (the condition in which chalks and marls exist,) limestone acts with much less efficiency than if burnt.

Lime, next to ashes, either as a carbonate or sulphate, has been instrumental in the improvement of our soils beyond any other saline manures. Like ashes too, its application is beneficial to every soil, not already sufficiently charged with it. It makes heavy land lighter, and light land heavier; it gives adhesiveness to creeping sands or leachy gravel, and comparative openness and porosity to tenacious clays; and it has a permanently beneficial effect where generally used, in disinfecting the atmosphere of any noxious vapors existing in it. It does not condense and retain the organic matters brought into contact with it by the air and rains, but it has the better effect of converting the insoluble matters in the soil into available food for plants. It has proved in many instances the wand of Midas, changing everything it touched into gold. It is the key to the strong box of the farmer, securely locking up his treasure till demanded for his own use, and yielding it profusely to his demands whenever required. In its influence in drying the land, and accelerating the growth of plants, the use of lime is equivalent to an increase of temperature; and the farmer sometimes experiences, in effect, the same benefit from it, as if his land were removed a degree or two to the south. The influence of lime in resuscitating soils after they have been exhausted, has been frequent and striking; and it may be stated as an incontrovertible truth, that wherever procurable at low prices, lime is one of the most economical and efficient agents in securing fertility, within the farmer's reach.

It has been falsely said to be an exhauster of soils; that it enriches the fathers and impoverishes the sons. So far as it gives the occupant of the land the control over its latent fertility, this is true, but if he squanders the rich products when within his reach, it will be his own fault. Lime gives him the power of exhausting his principal; if he uses aught beyond the interest, his prodigality is chargeable to his own folly, not to the liberality of his agent. By the addition of lime to the soil, the insoluble

ingredients contained in it are set free, and they are thus enabled to aid in the formation of plants, and larger crops and of better quality are the results. If these be taken from the soil, without a corresponding return of manure, exhaustion must follow. In the preceding table it is seen, that lime constitutes in all cases, only a very minute part of the entire plant; all the other ingredients must be added or the fertility of the soil cannot be sustained. But in the very abundance of the crops which lime affords, means are provided for the maintenance of the highest fertility. If they are consumed on the farm, their manure should be returned to the fields; and if sold, other manures should be procured to replace the substances from which they are formed.

A practice which has extensively prevailed for many years in sections of the Middle States, consists in alternating wheat and clover on strongly limed lands. The plan usually adopted is to give one year to wheat and two to clover, sometimes taking off the first clover crop for hay, and feeding off on the ground and plowing in the after growth for manure; and upon this, wheat is again sown. This course has succeeded in bringing into fine condition, many unprofitable fields. It may work well for years, but it is nevertheless faulty and improvident. Lime only is added directly to the soil, but clover draws from the air and moisture whatever food it can attract from them. There remain to be added, potash, soda, the phosphates and silicates, which the soil will soon cease to furnish sufficient for the wants of the wheat and clover removed, or sterility must inevitably follow.

The best method, *is to add in some form, the full amount of all the materials abstracted by the annual crop.* When this is done, the large dressing of lime will retain the accumulating fertility, far beyond what the soil would be capable of were it not for its agency, and it is in this that the great profit of farming consists.

Large crops only are profitable. The market value of many indifferent ones will hardly meet the expense of cultivation, and it is only the excess beyond this which is profit. It is evident that if 15 bushels per acre of wheat, be an average crop, and it

requires 12 bushels to pay all expenses of production, 3 bushels is the amount of profit. But if by the use of lime and ordinary manures, the product can be raised to 30 bushels per acre, the profit would be near the value of 12 or 15 bushels, after paying for the manures. Thus the advantage from good management may be five times that of neglect. This example is given as illustrating a principle and not as an exact measure of the difference between limed and unlimed land. We have seen large farms, worn out and worthless from long cropping, restored to more than their virgin fertility by the liberal application of lime.

Application of Lime.—It may be carried on to the ground immediately after burning, and placed in small heaps. There it may be left to slack by rains and the air, or it is better to reduce it at once with water if accessible, and then spread it preparatory to plowing. A good practice is to place it in large piles and cover it thickly with earth, which gradually reduces it to powder. It may then be carried where it is wanted, and spread from the cart. It is still better, when small quantities only are wanted, to add it to the compost after it has been thoroughly air-slacked, avoiding fermentation as far as practicable after it has been added, as its avidity for acids expels the ammonia, which is the most valuable of the volatile ingredients of the muck heap. A thick coating of earth over the whole, will arrest and retain much of the gas that would otherwise escape.

Fresh burnt lime does not act on the crops during the first year, and it may be prepared for action as well by mixing it with three or four times its bulk of earth, as by spreading it directly upon the ground.

Magnesian Lime.—Many of the limestones contain magnesia, and are called magnesian lime. The effect of this is a more energetic action, and where it is found in lime, the same result will be produced by the application of a less quantity. Oyster and all other shells of marine origin, afford pure lime by burning.

The amount to be used depends entirely on the soil. Some fertile lands contain over 30 per cent. in their natural state. Eight

hundred bushels of lime per acre, have been applied at one time to heavy clays and such soils as were full of vegetable mold, with decided benefit to the land. In the United States, the average for a first dressing, is from fifty to one hundred and twenty bushels per acre; which may be renewed every four or six years, at the rate of twenty to forty bushels. If an over-dose has been applied, time, or the addition of putrescent or green manures are the only correctives.

To give lime its fullest effect, it should be kept as near the surface as possible; and for this reason it is well to spread it after plowing, taking care to harrow it well in. Allow it then to remain in grass as long as possible. Its weight and minuteness give it a tendency to sink, and after a few years' cultivation, a large proportion of it will be found to have got beyond the depth of its most efficient action. This circumstance gives additional value to the system of under draining and subsoil plowing, which enable the atmosphere and roots to follow it, thus prolonging its effect and greatly augmenting the benefit to crops. It should be spread upon the ground immediately after taking off the last crop, so as to allow all the time possible for its action before the next planting.

Application to Meadows.—In addition to its other good effects, lime like ashes, is useful to meadows in destroying the mosses and decomposing the accumulated vegetable decay on the surface. For this purpose it may be spread on them unmixed, after having first passed into the state of carbonate or effete lime, to prevent injury to the grass. If no such necessity require its use in this form, it may be combined advantageously with the muck and scattered broadcast over the meadow.

MARLS.

Marls are composed of carbonate of lime, mixed with clay, sand, or loam, and frequently with sulphate and phosphate of lime. They are a useful application to land in consequence of the lime they yield, and when containing the phosphate in addi-

tion, their value is largely increased. The quantity that may be advantageously used is even more variable than that of pure lime, inasmuch as the quality varies with every bed in which it is found. They are adapted to the improvement of all soils, unless such as are already sufficiently filled with lime, and they are more generally useful to meadows than the pure carbonate. Their benefits will be greatly enhanced if the clay marl be used on light or sandy soils, and sandy marls on clay and heavy lands. From 20 to 400 cart loads of marl per acre have been applied, according to its quality and the character of the land to be benefited. Circumstances must alone determine the proper quantity to be used. Marl should be carried out and exposed in small heaps before spreading on the land. Exposure to the sun, and especially to the frosts of winter, is necessary to prepare it for use.

SHELL SAND.

This is a calcareous sand, sometimes mixed with animal matter. It abounds in some parts of the coast of Cornwall, and on the western shores of Scotland and Ireland. It is also found on the coast of France, and particularly in Brittany, where it is known by the name of *trez.* This produces prodigious effects on peaty clay, and other soils, to which it is applied at the rate of 10 to 15 tons per acre. It is so much esteemed for the former, that it is sometimes carried to a distance of 100 miles. It is probable there are similar deposits on the coast of some of the Atlantic States, though we are not aware of any such application for agricultural objects. Its great value as a top dressing, will fully justify exploration, for the purpose of detecting it wherever it may exist.

GREEN SAND MARL.

There are extensive beds of a green sand (generally though improperly termed) marl, which run through a section of New Jersey, from which farmers have derived an astonishing addition to their crops. It is found by analysis to contain but a small quantity of lime, but it readily yields a large amount of potash,

varying from 6 to 15 per cent. From a careful analysis of eight different specimens, Prof. Rodgers found in it an average of 10 per cent. of potassa. The effect of this applied to the barren sands which abound in that neighborhood, has been so favorable, that lands which before could be bought for $3 per acre, would afterwards bring $40 to $100. Several deposits of green sand in the counties of Plymouth and Barnstable, Mass., similar in external appearance to the foregoing, were explored by Prof. Hitchcock, and specimens were analyzed by Dr. Dana, without however, detecting any qualities of decided advantage to agriculture.

GAS LIME.

This is the spent lime of the gas works, and a most useful top dressing for soils requiring lime, or gypsum. It may be drawn out in the fall or winter season, and if not intended for composts, dumped in small heaps, and especially, if fresh, it should be spread at once upon the surface, so as to be well exposed to the air. It may be applied to either grass, or plowed crops, with equal benefit, operating in much the same way as gypsum, although it should be spread in several times the quantity per acre. Caution must always attend its use, for without several months exposure, it exercises a poisonous influence upon vegetation.

GYPSUM—PLASTER OF PARIS—OR SULPHATE OF LIME.

This is a combination of lime with sulphuric acid and water, in the proportion of 28 of lime, 40 of acid, and 18 of water. It is frequently found in connection with carbonate of lime, clay, etc. The use of gypsum has been attended with great benefit in most parts of the United States; and by many of the most experienced farmers, is justly considered as indispensable to good farming. Like all saline, and indeed like all other manures, it acts beneficially only on soils which are free from standing water, or which may be saturated with it. It is felt most on sandy, loamy, and generally on clay soils, requiring more for the latter, and for all such as contain a large proportion of vegetable matter. From two pecks on sandy, to fifteen bushels on clay soil

have been applied per acre; but from two to four bushels is the usual quantity.

The crops on which it produces the greatest effect, are the red and white clover, lucern and sainfoin, and the leguminous plants, peas, beans, etc. On natural meadows and the cereal grains, it has no perceptible influence.

It should be sown broadcast as soon as the leaves have expanded in the spring. It takes four hundred and sixty times its weight of water to dissolve it, which shows the necessity of applying it while the early rains are abundant, and the increased effect of sowing it on the leaves, requires that its application should be deferred till they have become partially developed. For corn, potatoes, turnips, etc., it is usually put in with the seed, or sprinkled upon them after the first hoeing.

From its great effect on the clovers, increasing them sometimes to twice, and in rare instances, to thrice the quantity produced without it, it is manifest that it is the most profitable manure which can be used, as it can be generally procured by farmers at from $5 to $12 per ton. Yet it should be fully understood, that like lime and ashes, it furnishes only a part of the food of plants; and like them too, the addition of vegetable and animal manures is indispensable to secure permanent fertility.

Extensive sections of this and other countries, particularly in Great Britain, apparently derive no benefit from the application of gypsum. This failure has been variously ascribed to there being already enough in the soil; or to the presence of a marine atmosphere. Its great usefulness however, on many parts of our Atlantic coast, would seem to require some other explanation than the last as the cause of its inefficiency. Experiment alone can determine the circumstances which will justify its application, and to this test should not only this, but all other practices of the farmer be rigidly subjected.

BONES.

About 33 per cent. of fresh bone, consists of animal matter, (oil, gelatine, etc.,) from 53 to 56 per cent. of phosphate of

lime, and the remainder is principally carbonate of lime, soda and magnesia. There is no part of the bone that is not useful to vegetation; it is especially so to the various kinds of grain, to potatoes, turnips, the clovers, peas and beans. The bones should be crushed or ground, and then drilled in with the seed, or scattered broadcast, at the rate of twenty-five bushels per acre. They may be repeated in less quantities every four or five years, or till the soil ceases to be improved by them, when they should be withheld till additional cropping shall have so far exhausted them as to justify a further supply.

Bones are generally boiled before using for manure, to extract the oil and glue. This does not lessen their value for agricultural purposes, beyond the diminution of their weight, while it hastens their action. They are sometimes burned, which drives off all the organic matter, leaving only the lime, etc., to benefit the soil. This is a wasteful practice, though the effect is more immediate on the crops; but it is also more transient, and they require to be more frequently renewed. Bones ought always to be saved; and if not practicable to crush them, they may be thrown upon the land, where they will gradually corrode and impart their fertilizing properties. When partially decomposed and buried just beneath the surface, the roots of the luxuriant plants above will twine around them in all directions, to suck out the rich food which ministers so freely to their growth. Crushed bones are advantageously used with nearly an equal amount of ashes, or with one-third their weight of gypsum; or, as with nearly all other saline manures, they may be added to the muck heap. Pastures which have been long grazed, can be wonderfully benefited by applications of bone dust, sowed broadcast on their surface, at the rate of fifty to two hundred pounds per acre.

PHOSPHATE OF LIME.

This exists in a fossil state, and is known in some of its forms as *apatite*, *phosphorite*, etc. An extensive quarry is found in Estramadura, in Spain, and smaller deposits of it have been discov-

ered in different parts of the United States, under a variety of names. It is probable it may yet be found in such localities and in such quantity as to be useful to the farmer. It has been shown that more than half of the whole weight of bones consists of pure phosphate of lime; its value therefore is apparent. This may be applied to exhausted pastures in the same manner as bone dust.

SALT—OR CHLORIDE OF SODIUM,

Is variously obtained, as fossil or rock salt; from boiling or evaporation of salt springs; and from the waters of the ocean. In a pure state it consists of 60 of chlorine and 40 of sodium, in every 100 parts. Sodium, chemically combined with oxygen, forms soda; and it will be seen by referring to the table on page 45, that salt furnishes two of the important constituents in the ash of every vegetable. Its advantage to vegetation is to be inferred from a knowledge of its composition, which is fully sustained by experience. As a manure, salt was extensively used by the ancients, and has ever since been employed by intelligent agriculturists. On some soils it yields no apparent benefit. Such as are near the sea-coast, and occasionally receive deposits from the salt spray, which is often carried far inland by the ocean storms; or such as contain chlorine and soda in any other forms, are not affected by it. But in other situations, when used at the rate of three to sixteen bushels per acre, the crops of grains, roots or grasses have been increased from 20 to 50 per cent. It may be applied in minute portions in the hill, or scattered broadcast, or mixed with the muck heap. Its great affinity for water has the effect, like that of gypsum, of attracting dews and atmospheric vapor to the growing vegetation, by which it is supplied with moisture in a period of drought, much beyond what is conveyed to such as are destitute of these manures. Salt is also useful in destroying slugs, worms, and larvæ which frequently do much injury to the crops.

SULPHATE OF SODA, (GLAUBER SALTS,) SULPHATE OF MAGNESIA, (EPSOM SALTS,) AND SULPHATE OF POTASH.

These are all useful manures, and they act on vegetation in a manner similar to gypsum. This was to have been expected so far as the sulphuric acid is concerned, which is common to each; but their action is modified to a certain degree by the influence of the base or alkaline ingredients on the plants. The generally increased price which they bear over gypsum, will prevent their use away from those localities where they exist in a state of nature, or where they may be procured at low rates, near the laboratories in which they are manufactured.

NITRATE OF POTASH, (SALTPETRE,) AND NITRATE OF SODA.

These are both found in a crude state in native beds, or as an efflorescence; and in this condition they can frequently be bought at a price which will justify their use. The first contains potash, 46½, and nitric acid, 53½; the second, in its dry state, soda, 36½, and nitric acid, 63½, in every 100 parts. Numerous experiments have been tried with them on various crops; but they have not thus far, afforded very accurate or satisfactory results. In general, they give a darker color and more rapid growth, and they increase the weight of clover, grass, and the straw of grain; and the former are more relished by cattle. But in the average effects upon grain and roots, the statements are too much at variance to deduce any well settled principles.*

As a soak or steep for seeds, and especially when dissolved and added to the bed where they are planted, there is no doubt of their great value in giving an early and vigorous start to vegetables. This enables them rapidly to push forward their roots, stems and leaves, thus obtaining a greater range for the roots, and more mouths for the leaves to draw their nourishment from the atmosphere.

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* From the decidedly beneficial effects, produced in numerous instances, may we not reasonably infer, that they have generally been successful where there has been a deficiency of them in the soil?

CARBONATES, NITRATES, SULPHATES, PHOSPHATES, SILICATES, AND CHLORIDES.

Several of these have just been particularly enumerated. The remainder are composed of carbonic, nitric, sulphuric and phosphoric acids, silica and chlorine, in chemical combination with potash, soda, lime, and the other bases of plants. Although no one of these can fail to benefit crops, when rightly applied, yet the expense of most of them will prevent their extended use. This can only be looked for from those which are procurable at a cheap rate. The chemical laboratories, glass works and some other manufactories, afford in their refuse materials, more or less of these mineral manures, which would well repay the farmer for removing and applying to his land. The most obvious that occur in this country, are all that will be here mentioned.

OLD LIME PLASTER, FROM WALLS OF BUILDINGS, ETC.

This is a true silicate of lime, being formed mostly of siliceous sand and lime, chemically combined. For meadows, and for most other crops, especially on clays and loams, this is worth twice its weight in hay; as it will produce a large growth of grass for years in succession, without other manure. This effect is due not only to the lime and sand, but to the nitric acid which they have abstracted from the atmosphere, and which they continue alternately (while in combination) to absorb from the air and give out to the growing plant. But the farmer cannot too carefully remember, that with this, as with all other saline manures, but a part of the ingredients only is thus supplied to vegetables; and without the addition of the others, the soil will sooner or later become exhausted.

BROKEN BRICK AND BURNT CLAY.

These are composed mostly of silicate of alumina, generally mixed with silicate of potash and other substances. They are of much value as a top dressing for meadows. In addition to their furnishing in themselves a minute quantity of the food of plants, like old plaster, they serve a much more extended pur-

pose, by condensing ammonia, nitric acid, and the gases of the atmosphere.

POWDERED CHARCOAL,

Scattered over the ground, produces the same effect as the foregoing, and probably in a greater degree, as it absorbs and condenses the nutritive gases within its pores, to the amount of from twenty to over eighty times its own bulk. The economy and benefit of such applications can be readily understood, as they are continually gleaning these floating materials from the air, and storing them up as food for plants. Charcoal as well as lime, often checks rust in wheat, and mildew in other crops; and in all cases mitigates their ravages, where it does not wholly prevent them.

SUPER-PHOSPHATE OF LIME.

This article has of late years become extensively used for the lighter garden lands, and is valuable as a ready and active stimu lant to the growth of plants.

In chemistry, according to Professor Johnson, of New Haven, this is a soluble salt, composed of one equivalent of phosphoric acid, one of lime, and two of water. It should be the character istic ingredient of commercial super-phosphate. All compositions of this character should be well understood and used with judg ment. So convenient are these applications, so active as manures, and so great the demand for them, much fraud has been practiced in their manufacture; spurious and almost worthless imitations have been and are constantly imposed upon the public, in place of the genuine article.

The best super-phosphate is composed of ground bone, bone black, or phosphorite, acted upon by sulphuric acid, (oil of vitriol,) which renders a considerable portion of the phosphoric acid soluble in water. It is a powerful fertilizer, as well as portable and convenient, and of great value to the small cultivator and gardener, as well as in green-houses, hot-beds, etc. It is also very extensively employed for field crops, especially for turnips

of all kinds, cabbages, etc. In commerce, it is often mingled with guano, and with other commercial manures. Animal matter of any kind, properly treated with acids and earthy substances, afford valuable and powerful manures, sometimes not over agreeable in the handling, but quick in their action and lasting in the soil.

CRUSHED MICA, FELDSPAR, LAVA, THE TRAP ROCKS, ETC.

Feldspar contains 66.75 of silica; 17.50 alumina; 12 potash; 1.25 lime; and 0.75 oxide of iron. *Mica* consists of silica, 46.22; alumina, 34.52; peroxide of iron, 6.04; potash, 8.22; magnesia and manganese, 2.11. Most of the *lavas* and *trap rocks* hold large quantities of potash, lime, and other fertilizing ingredients. The last frequently form the entire soils in volcanic countries, as in Sicily, and around Mount Vesuvius in Italy, in the Azores and Sandwich Islands; and their value for grains and all cultivated plants is seen in the luxuriance of their crops and the durability of their soils. These examples illustrate the great influence of saline manures, and their near approach to an entire independence in sustaining vegetation. Whenever they become exhausted by the severe usage they undergo, two or three years of rest enables them again to yield a remunerating crop to the improvident husbandman. *Granite, sienite, and some other rocks*, yielding large proportions of potash and some lime, abound throughout the eastern portion of this country. The potash in them is, however, firmly held in an insoluble state; but if it be subjected to a strong heat, it may afterwards be crushed, and then yield it in an easily soluble form, and constitute a valuable top dressing for lands.

It is a subject of frequent remark, that the soil underneath, or in immediate contact with some stone walls, which have been erected for a long period, is much richer than the adjoining parts of the same fields. This difference is probably due, in some measure, to the slow decomposition of important fertilizers in the stone, which are washed down by the rains and become incorporated in the soil. The removal of stones from a fertile field, has been deprecated by many an observing farmer, as materially

impairing its productiveness. Beyond the shade thus afforded against an intense sun, protection from cold winds, their influence in condensing moisture, (and the beneficial effects which perhaps ensue, as in *fibrous covering*,) the difference may be attributable to the same cause.

SPENT LYE OF THE ASHERIES,

Is the liquid which remains after the combination of the lye and grease in manufacturing soap. It is of great value for plants. Before its application to the land it should be mixed with peat or turf, or diluted with ten times its bulk of water. Five gallons of this lye is estimated to contain as much potash or soda, according as either is used, as would be furnished by three barrels of ashes. It has besides, a large quantity of nitrogen, the most valuable ingredient of animal manure, which by judicious application, is either converted into ammonia, or serves the same purpose in yielding nutrition to plants.

AMMONIACAL LIQUOR (FROM GAS HOUSES,) GAS LIME, ETC.

This liquid is the residuum of bituminous coal and tar used in making gas, and holds large quantities of nitrogen, from which ammonia is frequently extracted. When used for land near by, it may be carried to the muck heap in barrels; and when at remote distances, gypsum or charcoal dust may be added to the barrel, stirring it well for some time, and then closely covering it. The gypsum and charcoal soon combine with the ammonia, when the liquid may be drawn off, and the solid contents removed. It is a powerful manure, and should be sparingly used. Gas lime may be laid in small heaps and spread on the soil, or thrown broadcast from the cart or wagon. (See page 54.)

GUANO

Is derived exclusively from the animal creation, but from its existence in a highly condensed state, and in combination with large proportions of the salts, and having by its accumulation through thousands of years, lost the distinguishing characteristics

of recent animal matter, it may almost be considered as a fossil, and is properly enough classed under the head of inorganic manures. It is the remains of the dung, feathers, eggs, food and carcasses of innumerable flocks of marine birds, which have made some of the islands in the Pacific and Atlantic oceans, places of resort for rearing their young through unknown ages. It is found in the Pacific, near the coast of Peru, between latitude 13° and 21° south, where the rain never falls; and in some places it has accumulated to the enormous height of 60 and 80 feet. Yet such has been the demand for this justly popular fertilizer, that many million tons were imported into England from July, 1844, to the same period in 1868, at an average value of $40 per ton. A comparatively small amount has been taken to other countries, including the United States. Its value has been known and appreciated from time immemorial by the Peruvians, who transferred it to the continent, and used it for various crops.

Different specimens vary greatly as to quality. The average analysis of Dr. Ure's examinations is:

Organic matter containing nitrogen, including urate of ammonia, and capable of affording from 8 to 17 per cent. of ammonia by slow change in the soil,	50
Water 11. Phosphate of lime 25,	36
Ammonia, phosphate of magnesia, phosphate of ammonia and oxalate of ammonia, containing from 4 to 9 per cent. of ammonia,	13
Silicious matter from the crops of birds,	1
	100

The above analysis shows a strongly concentrated manure, and it is certain it is much above the medium, as the sand alone is sometimes 15 or 20 per cent. It is applied to roots, grain, and other cultivated crops, and as a top dressing for grass; but it has thus far proved of most value to the former. Before using it as a top dressing, it is mixed with twice its bulk of fine earth, ashes, plaster or charcoal dust. The proper quantity is from 200 to 400 lbs. per acre, sown broadcast and harrowed in, or supplied in two dressings; the first soon after the plants appear, but not in contact with them; the last, ten or fourteen days after, and immediately

before moist or wet weather. The crops on poor soils are much improved, while those on rich lands have, in some cases, been injured by it. For hot houses and many minor purposes, it is a desirable manure, and in solution it is very convenient as an occasional dressing. It is thus prepared by dissolving 4 lbs. in 12 gallons of water, twenty-four hours before using. On account of its volatile character, it should be closely covered till wanted.

SOOT,

Like ashes, has its origin exclusively from vegetables, but may with them, be properly treated under the present head. It holds ammonia, charcoal and other rich ingredients, and is used at the rate of fifty to three hundred bushels per acre. It produces its greatest effects in moist weather, and in dry seasons it has sometimes proved positively injurious. It may be sown broadcast over the field and harrowed in, or mixed with such other manures as are intended for immediate use. The ammonia has a great tendency to escape, which can only be prevented by adequate absorbents, as earth or the like. Many experiments made with it have proved contradictory. In some, it has been shown to be useless for clovers, while it has proved of great service to several of the grasses. Salt enhances its effects. In an experiment made in England with potatoes, on three separate acres of land of equal quality, one without manure gave 160 bushels; one manured with 30 bushels of soot, yielded 196; and the third, which received the same quantity of soot and seven bushels of salt, yielded 236.

CHAPTER III.

ORGANIC MANURES.

THE PRINCIPLES CONSTITUTING ANIMAL AND VEGETABLE, PUTRESCENT OR ORGANIC MANURES.

From the table in the foregoing pages, on the ashes of plants, to which reference has been frequently made, it is shown that in burning dried vegetables, they lose from about 95 to 99 per cent. of their whole weight. The matter that has been expelled by heat, consists of four substances or ultimate principles: carbon, oxygen, hydrogen and nitrogen, of which carbon makes up from 40 to 50 per cent. or about one-half of the whole.

Carbon constitutes all of charcoal but the ash; nearly all of mineral coal, and plumbago or black lead; and even the brilliant diamond is but another form of carbon. The properties and uses of carbon are various and important; its agency in the growth of plants alone concerns us at the present time.

Carbonic Acid.—When any matter containing carbon is burnt, its minute particles or atoms combine with the oxygen which exists in the atmosphere, and form carbonic acid, consisting by weight, of six of the former and sixteen of the latter. When animals inhale air into their lungs a similar union takes place, the carbon contained in the system being brought to the surface of the lungs, and after uniting with the oxygen as carbonic acid, is expelled. Pure limestone or marble loses 46 per cent. of its weight by burning; and all of this loss is carbonic acid, which it slowly absorbs again on exposure to the air, or to such substances as contain it. It is evolved by fermentation, and if the surfaco

of a brewer's vat in full activity be closely observed in a clear light, it may be seen falling over the edges, when it gradually mingles with the air. Its density is such that it may be poured from one open vessel into another, without material loss. It is this which gives to artificial soda water and to mineral springs (as the Saratoga) their sparkling appearance and acid flavor. It abounds in certain caves, sunken pits, and wells, which destroy animal life, both from its intrinsic poisonous qualities, and from its excluding oxygen, which is essential to respiration. And it is from the same cause, that death ensues to such as are confined in a close room where charcoal is burnt.

This acid is an active and important agent in the incessant changes of nature. It is everywhere formed in vast quantities, by subterranean fires and volcanoes. Though heavier than atmospheric air, it mingles with it and is carried as high as examinations have yet been made, constituting in bulk, about one part in one thousand of the atmosphere, and something more than this in weight. Gay Lussac ascended in a balloon 21,735 feet, and there filled a bottle with air, which analysis showed to be identical in composition with that on the surface of the earth. Carbon is one of the great principles of vegetation, and it is only as carbonic acid, that it is absorbed by the roots, leaves and stems of vegetables, and by them is condensed and retained as solid matter.

OXYGEN, hydrogen and nitrogen, when uncombined with other substances, exist only as gases. The first makes up nearly one-half of all the substances of the globe; and with the exception of chlorine and iodine, it constitutes a large part of every material in the ash of plants. It forms rather over 21 per cent. by measure, and 23 by weight of the whole atmosphere; and about eight parts out of nine by weight of water, hydrogen making up the remainder. It is absorbed and changed into new products by the respiration of animals, and it is an essential agent in combustion. Oxides are composed of it in union with the metals, alkalies, etc.; and most of the acids, as when combined with

other substances, nitrogen, sulphur and phosphorus. Its presence indeed, is almost universal, and the agency which it exerts in vegetable nutrition, is among the most varied and intricate manifested in vegetable life.

HYDROGEN is the lightest of all the gases. It is but one-fourteenth the weight of the atmosphere, and one-sixteenth the weight of oxygen; and from its great levity, it is used for filling balloons. It burns with a light flame when brought into contact with atmospheric air on applying a lighted taper, the combustion forming water.

It is largely evolved from certain springs, in connection with carbon or sulphur, and is called carbureted and sulphureted hydrogen, an offensively pungent and inflammable gas. So abund antly is this emitted from the earth in some places, that it is used for economical purposes. The inhabitants at Fredonia, N. Y., and in the petroleum oil regions of Pennsylvania and other States, light their buildings with it, and in the oil pumpings use it as fuel; and some of the salt manufacturers in the valley of the Ohio, apply it to evaporating the water of the saline springs. Carbureted hydrogen is the gas now employed for lighting cities. It is manufactured from oils, fat, tar, rosin, and bituminous coal, all of which yield large quantities of carbon and hydrogen. Both the carbon and hydrogen are entirely consumed with a brilliant light, when inflamed and exposed to the oxygen of the atmosphere. It is the residuum of these substances, after driving off the gas, which makes the ammoniacal liquor so useful as a manure; all the nitrogen with a part of the hydrogen, remaining. In combination with chlorine, one of the elements of salt, it constitutes the muriatic, one of the strongest of the acids.

Ammonia.—The most frequent condition besides water in which hydrogen is mentioned in connection vith vegetation, is when combined with nitrogen in the proportion of three of the former in bulk, to one of the latter; and by weight, 17.47 of the first, to 82.53 of the last, in every 100 parts, composing the

volatile alkali, ammonia, which is about six-tenths the density of the atmosphere. By strong compression at a low temperature, it may be condensed to a liquid having rather more than three-fourths the specific weight of water. It is never found in a tangible shape, except in combination with acids, forming carbonates, nitrates, sulphates, muriates, etc., of ammonia.

NITROGEN exists in the atmosphere to the extent of about 79 per cent. The principal purpose it appears to fulfill in this connection, is in diluting the oxygen, which in its pure state acts with too great intensity on animal life, in combustion, and all its various combinations. So great is the attraction of undiluted oxygen for iron, that a wire ignited by a taper and plunged into a jar of oxygen gas, will itself take fire and rapidly melt into irregular drops. This is nothing more than an illustration of the principle exhibited (in an intense degree) in the gradual rusting which takes place in the air at its ordinary temperature; or the more rapid formation of the scales under the heat of the blacksmith's forge. All are simple oxidations of the metal, or the combination of oxygen with iron; and we see in the comparison, the immensely accelerated effect produced by the absence of nitrogen.

Nitric acid is another compound of great importance to vegetation. It is simply nitrogen and oxygen; the identical materials which compose the atmosphere, combined in different proportions, 26.15 parts by weight of the former, and 73.85 of the latter in every 100. This acid, in union with potash, forms nitrate of potash, or saltpetre; and with soda, forms nitrate of soda. The latter occurs in immense beds, and lies upon and immediately under the surface of the earth in Chili, India and Spain. From Chili it is exported in large quantities, and has been extensively used in England of late years, as a manure.

It has been deemed relevant to our subject to say thus much respecting some of the most striking characteristics of those four simple principles, which make up an average of more than 98 per cent. of all living vegetables. And here a moment's reflection irresistibly forces from us an expression of wonder and admiration

at that Wisdom and Omnipotence, which, out of such limited means, has wrought such varied and beautiful results. Every plant that exists, from the obscure sea-weed 100 fathoms below the surface of the ocean, to the lofty pines that shoot up 300 feet in mid air; and from the clinging moss that seems almost a part of the rock on which it grows, to the expanded banyan tree of India, with its innumerably connected trunks, overshadowing acres; every thing that is pleasant to the taste, delightful to the eye, and grateful to the smell, equally with whatever is nauseous, revolting and loathsome, are only products of the same materials, slightly differing in association and arrangement.

BARN-YARD MANURE.

The first consideration in the management of manures, is to secure them against all waste. The bulk, solubility and peculiar tendency to fermentation of barn-yard manure, renders it a matter of no little study so to arrange it as to preserve all its good qualities and apply it undiminished to the soil. A part of the droppings of the cattle are necessarily left in the pastures, or about the stacks where they are fed; though it is better, for various reasons, that they should never receive their food from the stack. The manure thus left in the fields, should be beaten up and scattered with light long-handled mallets, immediately after the grass starts in the spring, and again before the rains commence in the autumn. With these exceptions, and the slight waste which may occur in driving cattle to and from the pasture, all the manure should be dropped either in the stables or yards. These should be so arranged that cattle may pass from one directly into the other; and the yard should, if possible, be furnished with wells, cisterns, or running water. There is twice the value of manure wasted annually on some farms in sending the cattle abroad to water, that would be required to provide it for them in the yard for fifty years.

The premises where the manure is dropped, should be kept as dry as possible; and the eaves should project several feet beyond the side of the building so as to protect the manure thrown out

of the stables, from the wash of rains. The barns and all the sheds should have eave-troughs to carry off the water, which if saved in a sufficiently capacious cistern, would furnish a supply for the cattle. The form of the yard ought to be dishing towards the center, and if on sandy or gravelly soil, it should be puddled or covered with clay to prevent the leaking and escape of the liquid manure. The floors of the stables may be so made, as to permit the urine to fall on a properly prepared bed of turf under them, where it would be retained till removed; or it should be led off by troughs into the yard or to a muck heap.

It is better to feed the straw and coarse fodder, which can always be advantageously done by cutting and mixing it with meal or roots. When it is not thus consumed, it may first be used as litter for the cattle, and as it becomes saturated with the droppings, it should be thrown into the yard. If the cattle are fed under sheds, the whole surface ought to be covered with such straw, refuse forage, etc., as can be collected; and if there is a deficiency of these, peat or any turf well filled with the roots of grass, and especially the rich wash from the road side may be substituted. The manure may be allowed to accumulate through the winter, unless it be more convenient to carry it on to the fields. When the warm weather approaches, a close attention to the manure is necessary. The escape of the frost permits circulation of the air through it, and the increasing heat of the sun promotes its decomposition.

Long and Short Manure.—The question has been often mooted as to the comparative advantages of long and short manure, (*the fermented and unfermented.*) This must depend on the use for which they are designed. If intended for the garden beds, or for loose light soils, or as a top dressing for meadows, or any crops, or if needed to kill any noxious seeds incorporated with the heap, it should be fermented; if for hoed crops in clay or loamy soils, it should be used in as fresh condition as possible. Loose soils are still further loosened for a time by long manure, and much of its volatile part is lost before it is reduced to mold

while adhesive and compact soils are improved by the coarse vegetables which tend to their separation; and all the gases which are set free in fermentation, are combined and firmly held in the soil.

Decomposition of Manures.—Three conditions are essential to produce rapid decomposition in manure: air, moisture, and a temperature above 65°, and these, except in frosty weather, are generally present in the heap. The gradual chemical changes going on in all manures, but most actively in the excrements of the horse and sheep, where they have sufficient air and moisture, induce an elevation which keeps them always above the low temperature of the surrounding air. If the manure be trodden compactly and saturated with water, the air cannot circulate, and if its temperature be likewise kept down, it will be preserved a long time unchanged.

The fermentation of manure should go forward when thoroughly blended with all the vegetable and liquid fertilizers about the premises, including urine, brine, soap-suds, ashes, gypsum and coal dust; the last three substances combining with the ammonia as it is formed. Over all these should be placed a good coating of turf, peat, or fine mold, which will absorb any gases that escape the gypsum, etc. Old mortar or effete lime may also be added for the formation of nitric acid. It draws this not only from the materials in the heap, but largely also from the nitrogen of the air, it having been ascertained in the manufacture of saltpetre, (nitrate of potash,) that the amount of nitrogen in the salt, is greatly increased above that in the manure used. The absorption of nitre by lime in a course of years, is found to be large, as is seen by the practice of the Chinese farmers, who to secure it will gratuitously remove the old plaster on walls and replace it with new. If required to hasten decay, and especially if there be intractable vegetables, as broom and other cornstalks, or such as have seeds that ought to be destroyed, they may be well moistened and thrown together in layers three or four inches thick, and on each may be strewn a liberal coating of fresh unslacked lime,

reduced to powder. This promotes decomposition, and when it is far enough advanced, the whole may be sparingly added to the general mass, as the lime will by that time have become mild. These coarse materials, when remote from the cattle yard, may be at once burned, and the ashes added to the soil, or they may be buried in furrows, where the ground will not be disturbed, till they are entirely rotted.

When thoroughly decomposed, the manure heap will have lost half its original weight, most of which has escaped as water and carbonic acid. It may then be carted on to the ground, and at once incorporated with it; or if intended for a top dressing, it should be scattered over it immediately before or during wet weather. For the protection of the manure, it would be well to cover it with a roof and convey off all the water from the eaves. This will prevent any waste of the soluble matter, and promote the escape of moisture by the free circulation of air, which to the extent of this evaporation, will lessen the labor of hauling.

Tanks for holding Liquid Manure have long been in use. They should be convenient to the stalls and yards, and tight drains should convey into them every particle of the urine and drainage from the manure. In compact clay they may be made by simply excavating the earth, and the sides can be kept from falling in, by a rough wall, or by planks supported in an upright position by a framework of joist. But in all cases the cisterns should be *closely covered* to prevent the escape of the ammonia, which is developed while fermenting. In porous soils, it is necessary to construct them with stone or brick laid in water-lime or cement.

When partially filled, fermentation will soon take place in the tank, and especially in warm weather; gypsum or charcoal should then be thrown in to absorb the ammonia. A few days after decomposition commences, it should be pumped into casks and carried on to the land. If intended for watering plants, it must be diluted sufficiently to prevent injury to them. The quantity will depend on the strength of the liquid, and the time it is applied, much less water being necessary to dilute it in a wet than in a

dry time. By fermenting in the open air and undiluted, it has been found that in six weeks, cow's urine will lose nearly one-half of its solid matter or salts, and six-sevenths of its ammonia; while that which had been mixed with an equal quantity of water, lost only one-eighteenth of the former and one-ninth of the latter. The stables and troughs leading to the tank should be frequently washed down and sprinkled with gypsum. This last will absorb much of the ammonia which would otherwise escape. Some loss of the volatile matter must be expected, and the sooner it is used after proper fermentation, or ripeness, as it is termed, the greater will be the economy.

Liquid Manure applied to the muck heap.—As a general rule, it is more economical and a great saving of labor to keep the urine above ground and mix it at once with the manure; but in this case vegetable or earthly absorbents must be adequately supplied; and in addition, the heap ought frequently to be sprinkled with gypsum or charcoal. Rich turf, the wash of the roadside, tan-bark or sawdust, and all refuse vegetables may be used for this purpose, and so placed that the liquid can run on to them, or be deposited where it can be poured over it. The same protection of a rough open shed should be given to this as to the other heaps, to facilitate evaporation and prevent drenching from rains. When fully saturated with the urinary salts, and all is properly decomposed, it may be carried out for use, or closely covered with earth till wanted. The decomposition is in a great measure arrested by covering with compact earth, thoroughly trodden together; this prevents the access of air, which is essential to its progress.

A simple yet economical mode of saving the liquid manure, is sometimes adopted in Scotland, and is thus detailed:

"Divide a shed into two compartments, one of which we make water-tight, by puddling the side walls with clay to the height, say, of two feet, and separated from the other compartment by a low water-tight wall or boarding. This is my fermenting tank, which is filled half or three parts full of pulverized burnt peat,

and the liquid manure from the stable, pig-styes, etc., directed into it. This is mixed up with the pulverized peat, and allowed to remain three or four weeks, till the decomposition seems about completed, being occasionally stirred about after the composition has become about the consistency of gruel. The whole is then ladled (with a pole and bucket) over the low partition into the second floor, which is also three parts filled with the carbonized peat; and as the second floor is meant merely as a filter, we have it lower on one side than the other, by which means, in the course of a day or two, the carbonized peat is left comparatively dry. The water having passed off at the lower side, the first or fermenting floor is again filled as before, and the contents of the second floor, if considered saturated enough, are then shovelled up into a corner, and allowed to drip, and further dry till used, which may be either immediately, or at the end of twenty years, as scarcely anything will affect it, if not exposed to the continued washing of pure water, or exposed to the influence of the roots of growing plants. By being thinly spread on a granary floor, it soon becomes perfectly dry, and suited to pass through drill machines.

"The mixing of the carbonized peat with the liquid manure on the first or fermenting floor, it will be observed, is for laying hold of the gaseous matters as they escape during the fermentation; perhaps other substances may effect this more effectually, but none so cheaply. I think by this plan it will be obvious to every one that a great many desiderata are at once obtained. In the first place, you get free of over nine hundred parts out of every one thousand of the weight and bulk of manure, by the expulsion of the water; while at the same time you link all the fertilizing properties contained in it to one of the most handy vehicles—light, cleanly, and portable, and possessed of the peculiar property of holding together the most volatile substances, till gradually called forth by the exigencies of the growing plants. Lastly, you get free of the tank, hogshead and watering cart, with all its appendages, and are no more bothered with over-

flowing tank, or overfermented liquid, with weather unsuited to its application. You have merely to shovel past the saturated charcoal, and shovel in a little fresh stuff, and the process goes on again, while the prepared stuffs lie ready for all crops, all seasons, and all times." The best way of distributing liquid manure on the land, is by a hogshead on wheels, in the same manner as streets are watered.

VALUE OF LIQUID MANURES.—The urine voided from a single cow is considered in Flanders, where agricultural practice has reached a high state of advancement, to be worth $10 per year. It furnishes nine hundred pounds of solid matter, and at the price of $50 per ton, for which guano is frequently sold, the urine of a cow for one year is worth $20. And yet economical farmers will continue to waste urine and buy guano! "The urine of a cow for a year will manure one and a quarter acres of land, and is more valuable than its dung, in the ratio by bulk, of seven to six; and in real value as two to one."—*Dana.* How important then, that every particle of it be carefully husbanded for the crops.

The average urine of the cow, as analyzed by Sprengel, contains 92.6 per cent. of water; that of the horse, 94; the sheep, 96; the hog, 92.6; and the human, 93.3. The remainder is composed of salts and rich vegetable food; but the human is far richer in these than any other. The quantity and value of urine varies much, and depends on the food and liquid taken into the stomach, the loss by perspiration, etc.

SOLID ANIMAL MANURES.—Of these *Horse dung* is the richest and the easiest to decompose. If in heaps, fermentation will sometimes commence in twenty-four hours; and even in midwinter, if a large pile be accumulated, it will proceed with great rapidity; and if not arrested, a few weeks under favorable circumstances, are sufficient to reduce it to a small part of its original weight and value. Boussingault, one of the most careful observers of nature, as well as an accurate experimental chemist, states the nitrogen in fresh dried horse dung to be 2.7 per cent. The same manure laid in a thick stratum and permitted to

undergo entire decomposition, loses nine-tenths of its whole weight, and the remaining tenth when dried, gives only one per cent. of nitrogen. Such are the losses which follow the neglect of inconsiderate farmers. Peculiar care should therefore be taken to arrest this action at the precise point desired.

The manure of Sheep is rich and very active, and next to that of the horse is the most subject to heat and decompose. *The manure of Cattle and Swine* being of a colder nature, may be thrown in with that of the horse and sheep in alternate layers. If fresh manure be intermixed with straw and other absorbents, (vegetables, peat, turf, etc.,) and constantly added, the recent coating will combine with any volatile matters which fermentation develops in the lower part of the mass. Frequent turning of the manures is a practice attended with no benefit, but with the certainty of the escape of much of its valuable properties. Many farmers assign a distinct or peculiar merit to the different manures. Much of this opinion is fanciful, for there is frequently more difference in the comparative value of that from the same species, and even the same individual, at different times and under different circumstances, than from those of different species.

The diversity in manures may arise from several causes. The more thoroughly the food is digested and its nutritive qualities extracted, the less is the value of the manure. Thus on the same quantity and quality of food, a growing animal, or a cow in calf, or giving milk, yields a poorer quality of fœces, than such as are not increasing in weight, and if the animal be actually losing condition, the richness of the manure is very much increased. The quality of food adds materially to this difference, the richest giving by far the most valuable manure. Those animals which are kept on a scanty supply of straw or refuse hay, yield manure little better than good turf, and far inferior to the droppings of such as are highly fed. The imperfect mastication of the horse and mule, in comparison with the ruminating animals, the ox and the sheep, their generally better quality of food, and the fact that for the greater part of their lives they are not

adding to their carcass, is the cause of the increased value of their manure. Their solid fœces are also much richer than those of the cow, as they void less urine, and this is of an indifferent character. In a long series of careful experiments, made at Dresden and Berlin by order of the Saxon and Prussian governments, it was ascertained that soil which would yield three for one sown, when dressed with cow dung would give seven; with horse dung, ten; and with human, fourteen.

POUDRETTE AND URATE.

Poudrette is the name given to the human fœces after it has been mixed with charcoal dust or charred peat, by which it is disinfected of its effluvia, and when dried it becomes a convenient article for use, and even for remote transportation. The odor is sometimes expelled by adding quicklime, but this removes with it much of the ammonia, and on this account should always be avoided.

Urate, as well as poudrette, should become an article of commerce. It can be made in large cities by collecting the urine and mixing with it one-sixth or one-seventh of its weight of ground gypsum, and allowing it to stand several days. This combines with a portion of the ammonia, after which it is dried and the liquid is thrown away. Only a part of the value is secured by this operation. It is sometimes prepared by the use of sulphuric acid, which is gradually added to urine and forms sulphate of ammonia, which is afterwards dried. This secures a greater amount of the valuable properties of the urine; but even this is not without waste.

Night Soil.—From the analysis of Berzelius, the excrements of a healthy man yielded water, 733; albumen, 9; bile, 9; muscilage fat and the animal matters, 167; saline matters, 12; and undecomposed food, 70, in 1,000 parts. When freed from water, 1,000 parts left of ash, 132; and this yielded, carbonate of soda, 8; sulphate of soda, with a little sulphate of potash, and phosphate of soda, 8; phosphate of lime and magnesia, and a trace of gypsum, 100; silica, 16.

Human urine, according to the same authority, gives in every 1,000 parts, of water, 933; urea, 30.1; uric acid, 1; free lactic acid, lactate of ammonia, and inseparable animal matter, 17.1; mucus of the bladder, 0.3; sulphate of potash, 3.7; sulphate of soda, 3.2; phosphate of soda, 2.9; phosphate of ammonia, 1.6; common salt, 4.5; sal ammoniac, 1.5; phosphates of lime, acid magnesia, with a trace of silica and of fluoride of calcuim, 1.1.

Urea, according to Prout, gives of carbon, 19.99; oxygen, 26.63; hydrogen, 6.65; nitrogen, 46.65. The analysis of Wœhler and Liebig differs immaterially from this. Such are the materials abounding in every ingredient that can minister to the production of plants, which are suffered to waste in the air, and taint its purity and healthfulness; or they are buried deep in the earth beyond the reach of any useful application, and even in this position, (frequently in villages, and always in cities,) they pollute the waters with their disgusting and poisonous effluvia. The water from one of the wells in Boston, examined by Dr. Jackson, gave an appreciable per centage of excrementitious matter.

THE TREATMENT OF NIGHT SOIL WITH DRIED EARTH.—An apparently perfect mode of managing human excrements has recently been introduced in England, and to a small extent in this country. It consists of mingling with them in their most recent state a small quantity of dried earth. This completely deodorizes them, making it possible to keep them in a sick room even, without annoyance, any desirable length of time. In the country, where it can be at once applied, tight wooden boxes may be used, with hooks on the outer side, to which a team may be attached, for drawing them wherever required. The boxes should have a coating at the bottom, of dried earth, and require to have added to them daily about a pound and a half of earth for each individual of the family, and to have the entire contents occasionally thoroughly commingled. This operation may be effected by a common hoe or shovel, or some simple mechanism may be devised to effect the same result. It has been found that the accumulations of these earth closets, when exposed again to the sun or air, and

thoroughly dried, are almost, if not quite, as efficient as fresh earth for using again and again in the closets and commodes, even after having been employed six or seven times. By this time they have become a very powerful fertilizer, superior to anything which has heretofore been used as night soil, or sold under the names of poudrette, tafeu, etc. It is certainly within the ability of families, in this way, not only to save large quantities of this valuable fertilizer, for use in their own gardens or on their farms; but, if they have no land, by being careful to encourage or secure its accumulation, they will not only add to their own health, comfort and cleanliness, but produce an article which will have a definite market value.

THE EXCREMENTS OF FOWLS.

These contain both the fœces and urine combined, and are next to night soil in value. They should be mixed at once with the soil, or with a compost where its volatile matters will be retained. They are very soluble, and when exposed to moisture, are liable to waste. They should be husbanded with economy and care.

FLESH, BLOOD, ETC.

When decomposed, these substances afford all the materials of manure in its most condensed form. Whenever procurable, they should be mixed with eight or ten times their weight of dry peat, turf, tan-bark or rich garden mold. A dead cow or horse thus buried in a bed of peat, will yield ten or fifteen loads of the richest manure. Butchers' offal will give twenty times its weight of more valuable manure than any from his cattle yards.

HAIR, HORNS, HOOFS, PELTS, WOOLEN RAGS, AND THE FLOCKS, AND WASTE OF WOOLEN MANUFACTORIES,

Are rich in every organic substance required by plants, and when mingled with the soil they gradually yield them, and afford a permanent and luxuriant growth to every cultivated crop. All

animal substances contain about fifteen or eighteen per cent. of nitrogen.

FISH—FISH GUANO—FISH POMACE—FISH OFFAL, ETC., OF THE MARKETS.

These articles are much used in this and other countries for manure. The moss-bonker, or bony-fish, and alewives, frequent the Atlantic coast in countless numbers, in the spring, and are caught in seines, and sold to the farmers by the wagon load. They are sometimes plowed into the soil with a spring crop, or are more frequently used for growing corn, for which purpose one or two fish are placed in each hill and buried with the seed. This was the system adopted by the aborigines of our country in raising their maize on exhausted lands, long before their occupancy, or even discovery by the whites. There is waste in this practice, as the soils used for corn are generally sandy, and the slight silicious covering imperfectly combines with the putrefying fish, and much of their gases thereby eludes the plant, to the excessive annoyance of the olfactories for miles around.

The proper method of using them is by composting with dry earth, in alternate layers of about three inches in thickness of fish to nine of earth, and over the whole a coating of two to four feet of soil is placed. A few weeks of warm weather suffices to decompose the fish, which unite with the soil, no perceptible effluvia escaping from the heap, so effectual is its absorption. A strong acrid smell is, however, noticeable, and when it has become thus offensive, it is a sure sign of its decay. It may then be overhauled and re-mixed with more earth, for further decomposition, if in warm weather. It may at any time thereafter be applied to the use of growing crops, or, in the colder seasons and in low temperature, be preserved a long time for future use. It is suited to nearly all soils and crops. Oyster and clam shells and all other kind of mollusca, and fish debris, not readily decomposable by earthy mixtures, strewed over the surface, are also valuable as fertilizers.

SEA-WEED,

Is a powerful aid to the farmer when within convenient distances. It is thrown upon the sea-coast by the waves in large windrows, or it is carefully raked up from the rocks or bottom of the bays, either by farmers or those who make it a business to procure and sell it. It may be used as bedding for cattle, or litter for the barn-yard, or added directly to the compost heap. Where the distance for carrying it would prevent its use, it may be burned and the ashes removed to the land. It has much more saline matter than vegetables which grow on land, and yields a more valuable manure.

PEAT.

Much of our American peat is found equal in excellence to the same article in many parts of Northern Europe. There, its nearly pure carbonaceous quality admits of its extensive use as fuel. Many of our domestic peats are mixed with the wash from the adjacent elevations, which render them more easily susceptible of profitable cultivation in their native beds, and not less valuable as a fertilizer when applied to other lands. In six different specimens from Northampton, and four from other localities in Massachusetts, Dr. Dana found an average of 29.41 soluble, and 55.03 insoluble geine or humus; and 15.55 of salts and silicates in every 100 parts. The extensive researches of the same intelligent observer have led him to recommend the mixture of 30 lbs. potash, or 20 lbs. of soda ash, or what is more economical and equally efficacious, eight bushels of unleached wood ashes, with one cord of peat as it is dug from its bed; or, if leached ashes be used, they should be mixed in the proportion of one to three of peat. This he considers fully equivalent to pure cow dung in value. He also estimates the salts and humus of four cords of peat as equal to the manure of a cow for one year. The opinion of Mr. Phinney, a distinguished agriculturist of Lexington, Mass., founded on close observation and long

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practice, is that one part of green cattle dung composted with twice its bulk of peat, will make the whole as good as pure dung. Some peats are richer in ammonia than common barn-yard manure.

Peat, in its natural condition, contains from seventy to over ninety per cent. of water. It should be dug from its bed in the fall or winter for the purpose of draining or exposing it to the action of the atmosphere, when it will be found to have lost about two-thirds of its bulk. In this state it still holds about sixty-five per cent. of water. It may then be carted in to the cattle yards and used for making composts in any way desired.

MANURING WITH GREEN CROPS.

This system has within a few years been extensively adopted in some of the older settled portions of the United States. The comparative cheapness of land and its products, the high price of labor, and the consequent expense of making artificial manures, renders this at present the most economical plan which can be pursued. The object of this practice is, primarily, fertilization; and connected with it, is the clearing of the ground from noxious weeds, as in fallows, by plowing in the vegetation before the seed is ripened; and finally to loosen the soil and place it in the mellowest condition for the crops which are to succeed. Its results have been entirely successful, when steadily pursued with a due consideration of the objects sought, and the means by which they are to be accomplished. Lands in many of our Eastern States, which have been worn out by improvident cultivation, and unsalable at $10 an acre, have, by this means, while steadily remunerating their proprietors for all the outlay of labor and expense by their returning crops, been brought up in value to $50.

The full benefits of green crops seem only to be realized where there is sufficient calcareous matter in the soil. Calcareous soils, or such as have a large proportion of lime, however they may have become exhausted, when put under a thorough course of treatment, in which green crops at proper intervals are returned to them, are soon restored to fertility; and when lime does not

exist in the soil, the application of it in the proper manner and quantity will produce the same effect. Gypsum and ashes are the best substitutes, when lime or marl is difficult to be procured.

This system of improvement varies with almost every individual who practices it, according to the quality of his land, the kind of crops to be raised, the facility of procuring manures, the luxuriance of particular crops, etc. We shall state merely the general principles in this, as in most other subjects, and leave to the farmer's judgment to apply them according to his circumstances. It is always better to commence this system while the land is in good condition, as a luxuriant growth of vegetation is as profitable for turning in as for cropping. Buckwheat, rye, and some of the grasses, have been much used for this purpose in this country; and spurry, the white lupine, the vetch and rape, in Europe; but for the Northern portion of the Union, nothing has been hitherto tried which is so well fitted for the object as red clover.

Clover for Green Manures.—This is suited to all soils that will grow anything profitably, from sand, if possessing an adequate amount of fertility, to the heaviest clay, if drained of its superfluous water. The seed is cheap, its growth certain and rapid, and the expense of its cultivation trifling, while the return on a kindly soil and with proper treatment, is large. Added to this, and very much increasing its merits, is the abundance of its long tap roots, which penetrate the ground to a great depth and break up the stiff soils in a manner peculiarly beneficial to succeeding crops. The material yielded by the roots and stubble, is of itself equal to a good dressing of manure. It has the further advantage of giving two or more years' growth from one sowing, and of maintaining itself in the gronnd thereafter by self-seeding when not too closely cropped; and it is equally suited to profitable pasturage and winter forage.

If the first season of growth of clover be luxuriant after the removal of the grain upon which it was sown, it may be pastured in the autumn or suffered to fall and waste on the ground, the first being the most economical. The following year, the early

crops may be taken off for hay, and the second, after partially ripening its seeds, may be plowed in, and thus it carries with it a full crop of seed for future growth. It is usual when wheat is cultivated, to turn in the clover when in full flower in July, and allow the ground to remain undisturbed till the proper time for sowing the grain, when it may be shallowly cross-plowed, or worked by the "cultivator," when the wheat may be sown directly on the ground and harrowed in. This system gives alternate crops of grain and clover, and with the use of such saline manures as may be necessary to replace those abstracted from the soil, will sustain the greatest fertility. With a slight dressing of these when the land is in good condition, the first crop of clover may be taken off, and yet allow a sufficient growth for turning in.

It is customary, however, to adopt a three or four years' course of cropping, in which grain, roots, corn, etc., alternate with clover and barn-yard manures; and this we think the most approved practice when the land is within convenient distance of the manure. If the fields are remote, a still longer course would be preferable, where stock, and particularly sheep, are kept, as they might be allowed to pasture the field during a much greater time. Sheep would remove only so much of the forage as remains in their carcass; while milch cows and working animals would of course carry off a greater amount, the first in the milk and the last in their manure dropped while out of the field.

The Cow Pea is a rank, luxuriant producer, and is deemed the best of the fertilizers for the South; as it will there grow two crops in one season from two successive plantings. This is also a valuable fodder for cattle and sheep, and the ripe peas are a profitable crop. Like a luxuriant growth of clover, it requires the roller to prepare it properly for the plow.

Spurry is extensively used in the north of Europe, Flanders, Germany and Denmark, as a fertilizer and as forage for cattle, both in its green and dry state. It is admirably adapted to the lightest sands, where it is said to grow with more luxuriance and profit than any other of the cultivated plants. It may be sown in the fall after grain or early roots, and plowed in the following

spring. Three crops may be grown on the same land in one season. Van Voght says, by alternating these crops with rye, it will reclaim the worst sands, and yield nearly the same benefits if pastured off by cattle; while it adds materially to the advantages of other manures applied at the same time. It grows spontaneously in many of our fields as a weed, and its cultivation on our lightest sands, which are too poor for clover, might be attended with the best effects. Like the cow pea, however, it is deficient in the deep tap roots, which give much of their efficiency to the clover and white lupine.

White Lupine.—This plant has not, to our knowledge, been introduced as a field crop in this country; but from the great success which has attended its cultivation in Europe, it is a proper subject of consideration, whether it might not be advantageously introduced among us. It grows freely in all except calcareous soils, and is best suited to such as have a subsoil charged with iron. It is hardy, not liable to injury from insects, grows rapidly and with an abundance of stems, leaves and roots. The latter protects the plant from drought by penetrating through the subsoil for a depth of more than two feet, which they break up and prepare in the most efficient manner for succeeding crops.

The advantages of Green Manures consist principally in the addition of vegetable matter which they furnish to the soil. The presence of this, aids in the liberation of those mineral ingredients which are there locked up, and which on being set free, act with so much advantage to the crop. The roots also, exert a power in effecting this decomposition beyond any other known agents, either of nature or art. Their minute fibres are brought into contact with the elements of the soil, and they act upon them with a force peculiar to themselves alone, and which is far more efficacious than the intensest heat or strongest acids, persuading the elements to give up for their own use, what is essential to their maturity and perfection. By substituting a crop for a naked fallow, we have every fibre of the roots in the whole field aiding the ordinary decomposition which is slowly going forward in every soil.

Clover, and most broad leaved plants, draw largely for their sustenance from the air, especially when aided by the application of gypsum. By its long tap roots, it also draws much from the subsoil, as all plants appropriate such saline substances as are necessary to their maturity, and are brought to their roots in a state of solution by the up-welling moisture from beneath. This last is frequently a great source of improvement. The amount of carbon drawn from the air in the state of carbonic acid, and of ammonia and nitric acid, under favorable circumstances of soil and crop, are large; and when buried beneath the surface, all are saved and yield their fertility to the land; while such as decay on the surface lose much of their value by evaporation and drainage. In the green state, fermentation is rapid, and by resolving the matter of plants into their elements, it fits the ground at once for a succeeding crop.

APPLICATION OF MANURES.

In the application of the different manures, opinions among practical farmers somewhat differ, depending on the soils to which they are applied. And soils differ so greatly in their several compositions, that no positive rules can be laid down for their general application.

The ordinary barn-yard manures also differ largely in their composition, depending on the material from which they are made. It has already been seen that the *richer* the food given to farm stock, the better the manure will be, as grain yields the richest; good hay, corn blades, and mixed feeds of ground grain and straw come next; while the various straws, cornstalks, etc., yield the poorest of the three, and littered straw of any kind, not decomposed, makes the weakest of all. Yet, even this last, when partially decomposed, is a valuable manure.

APPLIED TO GRASS GROUNDS.

Again, the kind of crops proposed to be grown by aid of these manures, should measurably govern their application. On grass

grounds we hold that the fresher the manure the better, no matter if it be drawn out the day that it is thrown from the stable window, and spread equally over the soil. Foul seeds in fresh manures—and they are sometimes apt to be in them—will seldom take growth on a well compacted turf. The juices of the manure go down into the soil with the rains, or snows, while the seeds dry up and take no root. Yet, on hay meadows, these manures are best applied as soon after the hay is cut off as possible, during the latter summer or autumn, so that they may decompose through the winter, and not interfere with the growth of the spring grass. Spring manuring, or top dressing on grass grounds with coarse barn-yard dung, we would not recommend. Better let it lie over for the latter summer or fall season. It will be in the way of cutting the grass, and more or less of it work up, undecomposed, with the cut grass into the hay, and so injure it; while on pastures, it will taint the herbage and be distasteful to the animals cropping it. We believe, also, that it will be more beneficial to the coming crops so applied in the fall of the year.

APPLIED TO PLOWED CROPS,

Seeds are an objection to fresh manures, as straw, sea-weed, etc. They are often contained in them, as seeds of the grasses and various noxious weeds, which may sprout and grow in the pulverized soil with which they become intermixed, and thus cause much extra labor in eradicating them in hoed crops, or reproducing themselves in a much greater degree in crops of standing grain. For such purposes barn-yard manures should be partially, or wholly rotted. This may be done by throwing it into heaps outside the buildings, and composting it with soil, or occasionally turning it to let the seeds sprout, if they will, and die in the processes of the work.

We believe, both from our own experience, and the experience of others, that, *as a general rule*, the better way on hoed, or sown crops, is to *spread the manure on the surface, after the last plowing, and harrow it in with the planted or sowed crop.* By this

process enough of the juices of the manure will be washed into the soil to feed the roots, together with the *salts* and ammonia contained in it. By their action with the atmosphere, the stalks and leaves, which are the lungs of the plant, are forced into more rapid growth. This practice, we believe, acts on all soils alike.

When manures are plowed into clays, or loams, they are held long unaltered by the compactness of the soil above them, as without rain and sun acting *directly upon them*, they remain comparatively dormant, and are not decomposed, and they are of little use until again thrown up to the future action of the atmosphere. Therefore, for their *immediate* action on the crop they are of little use. On the lighter soils thus worked, manures may act much quicker than on the clays, or heavy loams, but they are more effective when near or quite upon the surface. Overflowed lands or river bottoms, always receive their washings on the surface, giving great yields of grass, and even when plowed their yields are better from a *second* plowing, which returns the washings thus brought upon them again to the surface.

It may be said to this plan of surface manuring, when it is seen smoking after a rain, that the ammonia is escaping, and blown off by winds into the atmosphere, is lost; or, that if a drought follows, it dries up and no benefit is derived from it. This occurs to a much less extent than might be supposed; and the fact remains that the crops get more benefit than if the manure were below the surface. This is especially true of grass and small grains. Without moisture, manure, in any position lies dormant. It can only become active with sufficient moisture to induce decomposition. Therefore it is not *lost* in its dryness whether under, or above ground; but its activity is more developed when near, or altogether on the surface.

All quick growing and vegetable substances, decomposed, make good manures, such as weeds, grass, potato tops, dry stalks of any kind, corncobs—in short, anything, except woody brush. And even that, if it could be finely cut, would soon decompose, and make good manure. Wood-chips, sawdust, wood-shavings,

and any other *fine* wood material acts *mechanically* in clay lands to great advantage, in loosening the soil and making it permeable to the rains and atmosphere, although it does not, immediately, much enrich it.

"Dust thou art, and unto dust shalt thou return," is as applicable to vegetable as to animal life, although applied in a very different sense here to that in which the text was originally uttered. Every decomposable thing, in fact, adds to the productiveness of our soils when properly applied.

THE FALLOW SYSTEM.

As a means of enriching lands, this was formerly much practiced, but it is now mostly discarded by intelligent farmers. It consists in plowing up the land and exposing it naked to the elements, whenever the exhaustion by tillage requires it. This practice is founded on the principle, that plants gradually exhaust the soil of such soluble food, potash, soda, etc., as are necessary to their support; and unless they are again given to it in manures, in a form suited to their immediate appropriation by plants, time is requisite for dissolving them in the soil so as to enable them again to support vegetation profitably. Besides the loss resulting from the frequent idleness of the land, naked fallows have this further disadvantage, and especially in light and loose soils; they are exposed to the full action of the sun and rains, and by evaporation and drainage are exhausted of much of their soluble vegetable food.

This system, bad as it is, may yet be absolutely necessary where grain alone is raised, and no manure is applied. But it is always avoidable by substituting fallow crops, as they are termed, potatoes, turnips, etc., with manure; or clover or other green crops, as above detailed; by which the land is cleared of weeds and sufficiently enriched for succeeding cultivation. Land is equally well prepared for grain by having been occupied as meadows, if they have been kept in good condition by top dressing, and pastures answer the same purpose without them.

CHAPTER IV.

IRRIGATION AND DRAINING.

Irrigation might properly enough be classed under the head of manures, for the materials which it provides are not only food for plants, but they aid also in procuring it from other sources. Water is of indispensable necessity to vegetable life, and the great quantity of it demanded for this purpose, is in most climates amply provided by nature in the stores of rain and dew which almost everywhere moisten the earth, and especially during the early growth of vegetation when it is most required. In countries where rain seldom or never falls, as in parts of South America, (the great plains west of the Mississippi and the Colorado, and the Utah valleys, and even into California, elevated above the dew point,) Egypt and elsewhere, the radiation of heat from the surface is so rapid under their clear skies, that excessive deposits of dew generally supply the plants with all the moisture which they need. The same effect takes place throughout most of the United States in our transparent summer atmosphere, and it is to the presence of copious dews on our rich, well cultivated fields, that much of the luxuriance and success is due, which has ever attended enlightened, well managed American husbandry.

Besides the moisture that abounds in the atmosphere, but which is not always available in rains and dews to the desired extent for the wants of vegetation, and that which imperceptibly ascends from remote depths in the earth and administers to the support of plants, it is a practice coeval with the earliest history of agriculture to bring artificial waters upon the cultivated fields, and make them contribute to the support of the crops. In many countries this system is indispensable to secure their maturity

for, although dews accomplish the object in a measure, they do not supply it in the quantity required to sustain a vigorous growth. We find in looking to the practice of Egypt and the Barbary States in Africa; of Syria, Babylon and other places in Asia; Italy, Spain and elsewhere in Europe, where husbandry early attained a high rank, that irrigation was extensively introduced. Damascus is one of the most ancient cities on record, (for it is mentioned in Genesis as existing nearly 4,000 years ago,) and notwithstanding its numerous successive masters, and its having been frequently subject to plunder and devastation when conquered, it is still a flourishing city, though in the midst of deserts. This is no doubt owing to the waters derived from the "Abana and Pharpar, rivers of Damascus," which are conducted above the city till they gush from the fountains and overspread the gardens, and subsequently water all the adjacent plain. Had it not been for irrigation, Damascus would doubtless, ages ago, have followed Palmyra, the Tadmor of the wilderness, into utter ruin. On no other principle than a systematic and extensive practice of irrigation, can we account for the once populous condition of Judea, Idumea and other vast regions in the East, which to the eye of the modern traveler present nothing but the idea of irreclaimable sterility and desolation. The possession of the "upper and nether springs" was as necessary to the occupant as possession of the soil.

When the Mormons first settled in Salt Lake Valley, the country was a barren wilderness from perpetual drought in the growing seasons of vegetation, but by aid of irrigation alone, it has become one of the most productive countries in the world.

In those countries where the drought is excessive and rains are seldom to be depended on, water is led on to the fields containing all the cultivated crops, and made subservient to their growth. But in the United States, and in the middle and northern parts of Europe, where the crops ordinarily attain a satisfactory size without its aid, irrigation is confined almost exclusively to grass or meadow lands.

All waters are suitable for this purpose excepting such as contain an excess of some mineral substances that are deleterious to vegetable life. Such are the drainage from peat swamps, from saline and mineral springs, and from ore beds of various kinds; and those are most frequent in which iron is held in solution. Of the spring, or ordinary river waters, those are the best which are denominated hard, and owe this quality to the presence of sulphate or carbonate of lime, or magnesia. Waters charged with fertilizing substances that have been washed out of soils by recent floods, are admirably suited to irrigation. Dr. Dana estimates the quantity of salts (in solution) and geine, or humus, which were borne seaward past Lowell, on the Merrimac river, in 1838, (a season of unusual freshets,) as reaching the enormous amount of 840,000 tons—enough to have given a good dressing to 100,000 acres of land. Such waters as have flowed out of the sewers of cities, or past slaughter houses and certain manufactories, and received the rich vegetable food thereby afforded, are the most beneficial when applied to vegetation. Meadows thus irrigated in the neighborhood of Edinburgh, have rented by the acre at the large sum of $250 per annum. But when none of these can be procured, pure spring water, apparently destitute of any soluble matters, may be advantageously used.

Besides its bringing of different matters from remote distances, water freely absorbs the gases (carbonic acid, oxygen and nitrogen, etc.,) in proportions altogether different from those existing in the air, and brings them to the roots by which they are greedily appropriated, and in its onward, agitated progress over the field, it again absorbs them from the air, again to be given up when demanded by the roots. When the water is permitted to remain stagnant on the surface, this good effect ceases; and so far from its promoting the growth of the useful and cultivated grasses, they speedily perish, and a race of sour and worthless aquatic plants spring up to supply their place.

Another and important office that water fulfills in ministering to the growth of vegetation, is in disposing the soil to those changes which are essential to its full maturity. Gypsum requires 460, and lime 778 times its bulk of water at 60° to dissolve them. Others among the mineral constituents of plants, also require the presence of large quantities of water to fit them for vegetable assimilation.

Time for Applying Water to Meadows.—In those regions where the winters are not severe, water may be kept in the fields during the entire season of frosts. This prevents its access to the ground, and on the approach of warm weather the grasses at once start into life, and give an early and abundant yield. But in general this system cannot be successfully practiced. The water is admitted at proper intervals, freely during the spring and early part of the summer when vegetation is either just commencing or going forward rapidly. It is sufficient to flood the surface thoroughly, and then shut off the water for a time. In very dry weather this may be done with advantage every night. Continued watering, under a bright sun, is an unnatural condition with upland grasses, and could never be long continued without proving fatal to them. Neither should the water be applied after the grasses have commenced ripening. Nature is the proper guide in this, as in most of the operations of the farmer; and it will be seen how careful she is in ordinary seasons to provide an affluence of rains for the commencement of vegetation, while she as carefully withholds them when it approaches maturity. After the grass is cut, the water may be again let on to flood the meadows. Pastures may be irrigated at proper intervals throughout the year.

The Manner of Irrigating.—This must depend on the situation of the surface and the supply of water. Sometimes reservoirs are made for its reception from rains or inundations, and sometimes it is collected at a vast expense from springs found by deep excavations, and led out by extensive subterraneous ditching. The usual source of supply, however, is from

streams or rivulets, or copious springs which discharge their water on elevated ground. The former are dammed up to turn the water into ditches or aqueducts, through which it is conducted to the fields, where it is divided into smaller rills, till it finally disappears. When it is desirable to bring more water on to meadows than is required for saturating the ground, and its escape to fields below is to be avoided, other ditches should be made on the lower sides to arrest and convey away the surplus water.

The advantages of irrigation are so manifest that they should never be neglected when the means for securing them are within economical reach. To determine what economy in this case is, we have to estimate, from careful experiment, the equivalent needed in annual dressing with manures to produce the same amount of grass as would be gained by irrigation; and to offset the cost of the manure, we must reckon the interest on the permanent fixtures of dam, sluices, etc., and the annual expense of attention and repair.

The quality of grass from irrigated meadows is but slightly inferior to that grown upon dry soils; and for pasturage it is found that animals do better in dry seasons upon the watered land, and in wet upon the dry. In Europe, where the disease is common, sheep are more liable to *rot* upon irrigated and marshy lands than on such as are free from excessive moisture. Dry land is more natural to sheep.

THE KIND OF SOILS SUITED TO IRRIGATION.—Light porous soils, and particularly gravels and sands, are the most benefited by irrigation. Yet, tenacious and clay soils are improved by it, and much more so when made porous by under draining. It is not only important that water be brought on to the ground, but it should pass off immediately after accomplishing the objects sought.

The increase from the application of water is sometimes fourfold, when the soil, the season and the water are all favorable, and it is seldom less than doubled. Many fields, which in their

natural condition, scarcely yield a bite of grass for cattle, when thoroughly irrigated, will give a good growth for years, and without the aid of any manures.

UNDER–DRAINING HEAVY AND TENACIOUS CLAY LANDS.

The advancement of agriculture in this country during the few last years, the high price of farming lands and their products within convenient distances of our larger markets, justify the commencement of an intelligent system of draining on such lands as require it. This system has for many years been introduced and largely practiced in England and Scotland, and of late years in various parts of the United States, and has resulted in the most signal success. The plan first adopted was, to excavate the land in parallel lines at intervals of sixteen to twenty-five feet, and to a depth of two to three feet, forming a slightly inclined plane on the bottom, which was from three to six inches wide, and gradually enlarging as it approached the surface. The narrowest drains were arched with inverted turf and clay, and so high as to allow of the requisite space at the bottom for the escape of whatever water might filter through the soil. Others were formed with continuous arched tiles laid on *a sole*, (a flat tile of the same material,) or a board placed on the bottom forming an uninterrupted conductor. Larger ditches were filled with rubble-stone (and in some instances brush,) to a sufficient depth, and then covered with soil. In all cases the smaller ones communicated by their outlets with large open drains which led the water from the field.

These drains were always below the reach of the plow, thus leaving the whole surface of the lands free from any obstruction to cultivation. Two recent improvements have beeu introduced which materially diminish the expense while they enhance the benefits of the system. They consist in sinking the drain to three feet, and using baked clay or tile pipes one and a half to two inches in diameter, and twelve to eighteen inches in length, connected by laying them simply end to end, or better, by short col-

lars made of sections of a size larger tile. The trifling opening at each joint is found to be sufficient to admit all the water which the drain can carry; while the increased depth at which the drainage takes place, draws the water from a much greater distance. With the depth indicated, it has been found that the drains, instead of being required once in sixteen to twenty-five feet, may be placed at intervals of thirty to forty, and accomplish the object with equal success, *and in less time.* The expense of under-draining varies exceedingly. It may run from thirty to fifty dollars per acre, as circumstances may govern. It has of late been ascertained, that in heavy soils, three feet is a sufficient depth, and thirty feet is about the proper distance apart for the most effective drainage.

The advantages of under-draining are numerous and important. It takes away all the surplus water which exists in heavy or tenacious soils, which in wet seasons is a serious impediment to the successful growth and perfection of vegetation; thus always insuring a full crop, when frequently not one-fourth of a crop is matured on similar undrained soils. It allows of early cultivation in spring and late in autumn, by furnishing a dry, warm soil, which would not admit of cultivation except in the warm part of the season; thus enabling the farmer to grow a greater variety of products where only a few were adapted to the soil before, and to these it gave several weeks' additional growth. It saves all the trouble and waste of surface drains and open furrows, which require that much of the land be left almost in an unproductive state, to serve as conductors of the surplus water. The rains falling on the convex surfaces of the lands, run off rapidly into the furrows, and not only prevent the benefit to the soil which would result from its absorption, but they carry with them much of the fine soil, which is thus allowed to waste. The long and the short of this matter of drainage is, that instead of leaving plain furrows above ground to let off the water, the under drains, acting the same as surface furrows, pass off the surplus water beneath, when it has done its office of watering the plants above.

Rain water is charged with some of the most important elements of nutrition to plants, and especially contains considerable proportions of carbonic acid and ammonia. If these be permitted to percolate through the soil, the roots of the plants, or in their absence the elements of the soil itself, absorb and form permanent combinations with them. Air also holds vegetable food, and it is necessary that this should penetrate through every portion of the soil where the fibres of the roots exist. Soils which are saturated with water do not admit of any air, unless the small proportion combined with the water; and from all such this vital adjunct of vegetation is excluded. The porosity of the land thus secured, facilitates the admission and escape of heat, which last condition is of the utmost consequence in promoting the deposition of dews.

The dense mass of saturated soil is impervious to air and remains cold and clammy. By draining it below the soil, the warm rains penetrate the entire mass, and there diffuse their genial temperature through the roots. Immediately pressing after these, the warm air rushes in and supplies its portion of augmented heat to the land. Porous soils thus readily imbibe heat, and they as readily part with it; every portion of their own surfaces radiating it when the air in contact with them is below their own temperature. This condition is precisely what is adapted to secure the deposit of the dews, so refreshing, and during a season of drought, so indispensable to the progress of vegetation. Dew can only be found on surfaces which are below the temperature of the surrounding air, and rapid radiation of the heat imbibed during the warmth of a summer's day is necessary to secure it in sufficient profusion for the demands of luxuriant vegetation in the absence of frequent showers.

An insensible deposit of moisture precisely analogous to dew, is constantly going forward in deep, rich, porous soils. Wherever the air penetrates them at a higher temperature than the soils themselves possess, it not only imparts to them a portion of its excess of heat, but with it also, so much of its combined moisture as its

thus lessened capacity for retaining latent heat compels it to relinquish. To the reflecting mind, imbued with even the first principles of science, these considerations will be justly deemed as of the highest consequence to the rapid and luxuriant growth and full development of vegetable life.

Another essential benefit derivable from drained lands, consists in the advantageous use which can be made of the subsoil plow. If there be no escape for the moisture which may have settled below the surface, the subsoil plow has been found to be injurious rather than beneficial. By loosening the earth it admits a larger deposit of water, which requires a longer time for evaporation and insensible drainage to discharge. When the water escapes freely, the use of the subsoil plow is attended with the best results. The broken earth, thus pulverized to a much greater depth and incorporated with the descending particles of vegetable sustenance, affords an enlarged range for the roots of plants, and in proportion to its extent, furnishes them with additional means of growth. The farmer thus has a means of augmenting his soil and its capacity for production wholly independent of increasing his superficial acres; for with many crops it matters not in the quantity of their production, whether he owns and cultivates one hundred acres of soil, one foot deep, or two hundred acres of soil, half a foot in depth. With the latter, however, he has to provide twice the capital in the first purchase, is at twice the cost in fencing, planting and tillage, and pays twice the taxes. The under drained and subsoiled fields have the further advantage of security and steady development in seasons of drought, as they derive their moisture from greater depths which are frequently unaffected by the parching heat. This secures to them a large yield while all around is parched and withered.*

A more enlarged and general, or what may justly be termed a philanthropic view of this system, will readily detect consider-

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* The experienced reader will sometimes notice the same ideas repeated under different heads. He must bear in mind that this work is intended *for learners;* and that it is of more consequence thoroughly to impress their minds with important principles, than to study brevity in communicating them.

ations of great moment, in the general healthfulness of climate which would result from the drainage of large areas, which are now saturated, or in many instances covered with stagnant waters, and which are suffered to pollute the atmosphere by their pestilent exhalations.

SPRING AND SWAMP DRAINING.

Springs are sometimes discovered, not by a free or open discharge of their water, but in extensive plats of wet, boggy lands, which are of no further use than to mire the cattle and bear a small quantity of inferior bog hay. These springs should be sought at the highest point where the ground appears moistened and led away to a ravine or rivulet, by a drain sufficiently deep to prevent the escape of any of the water into the adjacent soil; unless as it sometimes happens, the position and quality of water are suited to irrigation, when it may be conducted over the field for that purpose.

Swamps and Peat beds occur frequently in a hilly country. These are low, level, wet lands, whose constant saturation with water prevents their cultivation with any useful plants. The first object in effecting their improvement, is to find an outlet for the escape of the water to a depth of three to five feet below the surface, according to the area to be reclaimed; the greatest depth above specified being frequently necessary to the effectual drainage at all times, of an extended surface. If the water in the swamp has its origin in numerous springs from the adjoining hills, a ditch should be dug around the entire outer edge of it where it meets the ascending land. If the water be derived from a rivulet, a broad ditch should be made as direct as possible from its entrance to its outlet, and deep enough to lead off all the water. If these are found insufficient, additional ones may be made wherever required.

This subject of "under draining," in all its ramifications, requires a treatise of itself far too extended to enter into a work of this character Books have been written on the subject in all

its length and breadth of development. We therefore refer the reader to either of the volumes of French, or Waring, which may be readily found in the agricultural book stores of our principal cities.

Indeed, this subject of under draining has become so important in all heavy soils, worth, in their present condition, fifty dollars an acre, that their value may be doubled, for crop producing purposes, by the simple outlay of thirty to forty dollars in the simple process of under draining, which will last a lifetime.

Much time and ingenuity has been expended in the invention of machines for ditching for tile drains, and we have no doubt something of the kind will soon be perfected to reduce the cost of the process, to at least one-half the expense as now encountered by the plow and spade. Still, tile draining *will pay*, at the present expense. The only obstacle to present draining, to a great extent, is the want of *moneyed capital*, with the ordinary farmer to do it with; and when forehanded men, instead of investing their surplus gains in bonds, mortgages, and stocks, will apply them to under draining their farms, where needed, the better returns will they receive for the investment.

CHAPTER V.

MECHANICAL DIVISION OF SOILS.

SPADING.

After selecting a proper soil, and placing it in a suitable condition, as to manuring, draining, etc., the next most important consideration is the further preparation of the land for the reception of the seed. In small patches of highly cultivated land, spading is resorted to for breaking up and pulverizing the ground more effectually than can be done with the plow. This is the case with many of the market gardens in the neighborhood of our large cities, and with large portions of Holland, Flanders, and other countries of Europe. It is even contended by many highly intelligent and practical farmers in Great Britain, where labor is about half, and land and agricultural products nearly twice the average price with us, that spade husbandry can be adopted for general tillage crops with decided advantage to the farmer. However this may be abroad, it is certain it cannot be practiced in this country to any extent until some very remote period. The flat tined fork is equal to or better than the spade.

PLOWING.

This is the most important of the mechanical operations of the farm. The time, the depth and the manner of plowing must depend on the crops to be raised, the fertility and character of the soil, and other circumstances.

Plowing Clay Lands.—Whenever practicable, these should be plowed in the fall for planting and sowing the ensuing spring. The tenacity of the soil may thus be temporarily broken up by

the winter frosts, its particles more thoroughly separated, and the whole mass reduced to a finer tilth than can possibly be effected in any other manner. There is a still further and important advantage from this practice, which ensues from the attraction existing between the clay and those gases that are furnished from the atmosphere, snow, rains and dews. In consequence of being thus thrown up and coming in contact with them, it seizes upon the ammonia, and carbonic and nitric acids which are in the air, and holds them for the future use of the crops; while their great affinity for manures effectually prevents the waste of such as are in it.

The furrows of clay soils should be turned over so as to lap on the preceding and lie at an angle of 45°; and for this purpose the depth of the furrow slice should be about two-thirds its width. Thus, a furrow six inches deep should be about nine inches wide, or if eight inches deep, it should be twelve inches wide. This will allow of the furrows lying regularly and evenly, and in the proper position for the drainage of the soil, the free circulation of air, and the most efficient action of frosts which in this way have access to every side of them. Land thus thrown up is found to be finely pulverized after the frosts leave it, and it is comparatively dry and ready for use some time earlier than such as is not plowed till spring. For sowing, land plowed in this manner requires no additional plowing, but it is better fitted for the reception of seed than it can be by any further operation, unless by a slight harrowing if too rough. The different kinds of grain or peas may be dibbled in, or sown directly upon the surface and covered by the harrow; and if sown very early, the grass and clover seeds require no covering, but find their best position in the slight depressions which are everywhere made by the frost, and which the subsequent rains and winds fill up and cover sufficiently to secure a certain growth. When a field is intended for planting, and is thus plowed in the preceding autumn, in some instances, and especially when the soil is full of vegetable manures, as from a rich green sward, a single furrow where the

seed is to be dropped, is all that is necessary to be plowed in the spring.

If the land has been previously cultivated, (not in sward,) and is designed for planting, a stiff clay is sometimes ridged up by turning a double furrow, one on each side, and so close as partially to lap upon a narrow and unbroken surface, thus leaving the greatest elevations and depressions which can conveniently be made with the plow. The frost and air, by this means, have a greater surface to act upon than is afforded by thorough plowing, unless it be in a firm sod, which maintains its position without crumbling. The advantage of a dry surface and early working are equally secured by this latter method; and to prepare for planting the furrows need only to be split by running a plow through their center, when they are ready for the reception of the seed.

Plowing Sandy or Dry Soils.—These require flat plowing, which may be done when they are either quite wet or dry, but never till wanted for use. By exposure to heat, rains and atmospheric influences, the light soluble manures are exhaled or washed out, and they receive little compensation for this waste in any corresponding fertility they derive from the atmosphere in return. To insure flat plowing on an old sward, the depth of the furrow should be about one-half its width, and the land or ridges as wide as can conveniently be made, so as to preserve as much uniformity of surface over the whole field as possible.

Depth of Plowing.—All cultivated plants are benefited by a deep permeable soil, through which their roots can penetrate in search of food; and as a thorough depth of soil is not fully equivalent to its superficial extension, it is evident that there must be a great increase of product from this cause. For general tillage crops, the depth of soil may be gradually augmented to about twelve inches, with decided advantage. Such as are appropriated to gardens and horticultural purposes, may be deepened to fifteen and even eighteen inches to the manifest profit of their occupants. But whatever is the depth of the soil, the plow ought to turn up

the entire mass, if within its reach, and what is beyond it should be thoroughly broken up by the subsoil plow, and some of it occasionally incorporated with that upon the surface. The subsoil ought not to be brought out of its bed except in small quantities to be exposed to the atmosphere during the fall, winter and spring, or in a summer fallow; nor even then, but with the application of such fertilizers as are necessary to put it at once into a productive condition. The depth of the soil can alone determine the depth of plowing; and when that is too shallow, the gradual deepening of it should be sought by the use of proper materials for improvement till the object is fully attained. Two indifferent soils of opposite characters, as of a stiff clay and sliding sand, sometimes occupy the relation of surface and subsoil toward each other; and when intimately mixed and subjected to the meliorating influence of cultivation, they will frequently produce a soil of great value.

Cross Plowing is seldom necessary except to break up tough sward or tenacious soils; and the former is more effectually subdued by one thorough plowing in which the sod is so placed that decomposition will rapidly ensue; and the latter is more certainly pulverized by incorporating with it such vegetables, and long or unfermented manures, and the like, as will take the place of the decaying sod. The presence of these in the soil lessens the labor of cultivation, and greatly increases the products.

Subsoil Plowing.—This is a practice of comparatively recent introduction, and it has been attended with signal benefit from the increase and certainty of the crop. It is performed by subsoil plows made exclusively for this purpose. The objects to be accomplished are to loosen the hard earth below the reach of the ordinary plow, and permit the ready escape of the water which falls upon the surface, the circulation of air, and a more extended range for the roots of the plants, by which they procure additional nourishment, and secure the crop against drought, by penetrating into the regions of perpetual moisture. When all the circumstances are favorable to the use of the subsoil plow,

an increase in the crop of 20, 30, and sometimes even 50 per cent. has been attributed to its operations. Its maximum influence on stiff soils is reached only where under draining has been thoroughly carried out. Its benefits have been more than doubled when used in an impervious clay subsoil, where it makes further room for storing up stagnant water; and it is evident they can only aggravate the faults of such subsoils as are naturally too loose and leachy.

PLOWS AND OTHER FARM IMPLEMENTS.

There are plows for almost every situation and soil, in addition to several varieties which are exclusively used for the subsoil. Some are for heavy lands and some for light; some for stony soils, others for such as are full of roots; while still another class are expressly made for breaking up the hitherto untilled prairies of the west. Some are adapted to deep, and some to shallow plowing; and some are for plowing around a hill and throwing the furrows either up or down, or both ways alternately; others again throw the soil on both sides, and are used for plowing between the rows of corn or roots. Every farm should be supplied with such plows as are entirely adapted to the different operations required.

The farmer will find in the best agricultural warehouses, all the implements necessary to his operations, with such descriptions as will enable him to judge of their merits. Great attention has been bestowed on this subject for several years by skillful and intelligent persons, and great success has followed their efforts. The United States may safely challenge the world to exhibit better specimens of farming tools than she now furnishes, and her course is still one of improvement. There are numerous competitors for public favor in every description of farm implements; and an intelligent farmer cannot fail to select such as are best suited to his own situation and purposes.

The best only should be used. There has been a "penny wise and pound foolish" policy adopted by many farmers in their

neglect or refusal to supply themselves with good tools to work with. They thus save a few shillings in the first outlay, but frequently lose ten times as much by the use of indifferent ones, in the waste of labor and the inefficiency of their operations. A farmer should estimate the value of his own and his laborer's time as well as that of his teams, by dollars and cents; and, if it requires one-third, one-tenth, or even one-hundredth more of either to accomplish a given object with one instrument than with another, he should, before buying one of inferior quality, carefully compute the amount his false economy in the purchase will cost him before he has done with it. Poor men, or those who wish to thrive, can ill afford the extravagance of buying inferior tools at however low a price. The best are always the cheapest; not those of high or extravagant finish, or in any respect unnecessarily costly; but such as are plain and substantial, made on the best principles and of the most durable materials. To no tools do these remarks apply with so much force as to plows. The improvements in these have been greater than in any other instruments, the best saving fully one-half the labor formerly bestowed in accomplishing the same work.

HARROWS.

The object of the harrow is threefold: to pulverize the land, to cover the seed, and to extirpate weeds. Unless the land be very light and sandy, the operation should never be performed for either object, except when sufficiently dry to allow the crumbling down into a fine mellow surface under the action of the harrow. There are several varieties of harrows: the triangular and the square, both sometimes hinged and sometimes double; with long teeth and with short ones; some thickly set together and some far apart. For pulverizing firmly sodded or stiff clay lands, a heavy, compact harrow is required, with strong teeth sufficiently spread; and for lighter lands, or for covering seed, the more expanded harrow, with numerous, small and thickly set teeth. To pulverize soil, the harrow should move as quickly as possible, so

as to strike the lumps forcibly, and knock them to pieces; and for this purpose an active team is required. When the land sinks much under the pressure of oxen or horses' feet, light animals as mules or ponies are preferable.

THE ROLLER,

Is an important implement for many fields. It is always useful for pulverizing the soil, which it does by breaking down such clods and lumps as escape the harrow, and thus renders the field smooth for the scythe or cradle; and it is equally so on meadows which have become uneven from the influence of frost, ant-hills, or other causes. It is serviceable in covering seed by pressing the earth firmly around it, which thus secures moisture enough for germination. But its greatest benefit is with such sandy soils as are not sufficiently compact to hold the roots of plants firmly and retain a suitable moisture. With these it is invaluable, and the proper use of the roller has in some instances doubled the product. Its effect is similar to that produced by the frequent treading in a foot-path; and the observing farmer will not have failed to notice the single thread of thick greensward which marks its course over an otherwise almost barren field of sand or loose gravel. The thickly woven emerald net-work that indicates the sheep-walks, on similar soils, is principally due to the same cause.

Rollers are variously constructed. The simplest form is a single wooden shaft with gudgeons at each end, which rest in a square frame made by fastening four joists together, a tongue for drawing it being placed in one of its sides. A box may be attached to this frame for the purpose of holding stones and weeds picked up in the field, and for weighting the roller according to the work required. A roller should not exceed eight or ten feet in length, and should be divided in the middle and have an iron axle pass through each part, upon which they revolve, taking care to diminish the friction at the ends by a thick washer. The larger the roller, the greater the surface brought into contact with the ground, and the more level it leaves it, besides giving a much

easier draught to the team. To accomplish this without too much increase of weight, they are frequently constructed with heads at the ends and closely covered like a drum.

The best rollers, decidedly, are those made of cast iron segments, each revolving independently on an iron shaft, six to eight feet in length. The segments should be about a foot wide on the surface, a washer between each two, and as many segments on the shaft as will make a roller the desired length. The frame should be of iron, also, and a wooden box may be fitted on to the top to receive weights or collect stones from the field, as may be required. The tongue may be either of wood or iron. The segments may be from twenty to thirty-six inches diameter, according to the weight of roller needed. Such an implement will last almost "forever." To those who always leave their tools out of doors, it has an eminent advantage—it will not *rot*. But we house all our own tools, whether wood or iron, alike. Rust does not corrode, nor do thieves often break through and steal them.

THE CLOD CRUSHER.

This is a most admirable aud useful invention. It has long been used in Europe, and has lately been added to our American farm implements. It is made in the same way as the last mentioned iron roller, only with the addition of spikes, or corrugated sinuous teeth. It breaks the hard lumps of plowed ground for the harrow which follows it, or it may be applied to hide-bound and mossy meadows, and pastures, loosening and breaking the tough sward, and fitting it better to receive top dressings and fresh seeds. It is eminently a labor saving tool, and no good farmer should be without it. The large agricultural machinery establishments of the country now usually supply them.

THE CULTIVATOR,

Has a light frame in the form of a triangular or wedge harrow, with handles behind like those of a plow, and with several small iron teeth in the frame, somewhat resembling a double share plow.

They are of various sizes, slightly differing in construction, and are of great utility in stirring the surface of the ground and destroying weeds.

THE DRILL BARROW,

Is useful for dibbling in seeds, and when the surface is mellow, it will open the furrow for the reception of the seed, and drop, cover and roll the earth firmly over it. The smaller ones are trundled along like a wheelbarrow, by hand, and the larger, for field planting, having several fixtures for drilling, are drawn by horses. They are suited to the smaller seeds, and some have been made to plant corn, beans and peas successfully.

SURFACE OR SHOVEL PLOWS—SCARIFIERS.

These are a cheap, light instrument, much used in England, and to some extent in this country, for paring the stubble and grass roots on the surfaces of old meadows. These are raked together into heaps, and with whatever addition there may be of earth or clay are burnt, and the ashes and roasted earth scattered over the soil. There is an apparent objection to this practice in the expulsion of the carbon and nitrogen stored up in the plants and in the waste of the coarse material of the decaying vegetables, which is so useful in effecting the salutary mechanical divisions of clay soils. But by a reference to what has been said on the efficiency of burnt clay or broken brick, their great utility as fertilizers will be seen. This and the ash of the plants remain, and both are useful in quickening the action of soils and accelerating those changes so beneficial to vegetation; and even the reabsorption of the atmospheric gases, it is probable will more than compensate for their equivalents expelled in burning. The effect is farther salutary in destroying grubs, insects and their larvæ, and the seeds of noxious weeds.

THE WHEEL SPADER, OR TERRA-CULTOR.

This is a new digging implement recently invented, and intended to *spade* or pick the ground, leaving it in a finely comm-

nuted state, fit to receive the seed at once, with only the harrow to follow and finish the work. We have seen trials of several of these machines. They worked well in light loams and level ground, unobstructed by stones. But the power required for working them is great. A double team, say two or more spans of horses, are required, and the economy of their labor over plows has not yet been satisfactorily tested. We trust that they may yet be sufficiently perfected to come into every day use. It will be a most perfect implement for preparing the soil for seed, if its working can be brought within the draught of ordinary farm teams.

The lighter hand tools, as hoes, shovels, spades, rakes, hay, manure and spading forks, and a multiplicity of other small tools, are too commonly distributed and known to need particular remark. Various *new* and, sometimes, *improved* patterns, are constantly coming out to call the attention of the farmer and gardener.

A single remark on these hand implements may suffice. Always get the *best* to be had, and have enough of them. More time is frequently lost for the want of a cheap familiar tool than will twice pay the cost of it. No money is better expended on the farm than in an ample provision of all the tools and implements necessary for its thorough cultivation, as well as hand saving labor of any and every kind.

The grass mower, harvester and other implements for gathering and securing the grass and grain crops, will be mentioned upon treating of those important branches of our farm labor. Indeed, under the old hand systems of manual labor in getting in and harvesting our farm crops, their accomplishment, in present quantities, would be impossible, and the end is not yet. Steam plowing and cultivation, on our wide level lands, is yet to be accomplished. How soon, we cannot say, but measured by past inventions, the time, we trust, is not far distant. Gang-plows, sulky-cultivators, etc., are among the trial implements almost every year introduced, some of which have been quite successful.

CHAPTER VI.

THE GRASSES, CLOVERS, MEADOWS AND PASTURES.

THE *order* designated by naturalists as *Graminæ*, is one of the largest and most universally diffused in the vegetable kingdom. It is also the most important to man and to all the different tribes of graminiverous animals. It includes not only what are usually cultivated as grasses, but also rice, millet, wheat, rye, barley, oats, maize, sugar cane, broom corn, the wild cane and the bamboos sometimes reaching sixty feet in height. They are universally characterized as having a cylindrical stem, hollow, or sometimes, as in the sugar cane and bamboos, filled with a pithlike substance, with solid joints, and alternate leaves originating at each joint, surrounding the stem at their base and forming a sheath upwards of greater or less extent, and the flowers and seed are protected with a firm, strawlike covering, which is the chaff in the grain and grass seeds, and the husk in Indian corn. They yield large proportions of sugar, starch and fatty matter, besides those peculiarly animal products, albumen and fibrine, not only in the seeds, but also and especially before the latter are fully matured, in the stems, joints and leaves. These qualities give to them the great value which they possess in agriculture.

Of the grasses cultivated for the use of animals in England, there are said to be no less than two hundred varieties, while in the occupied portion of this country, embracing an indefinitely greater variety of latitude, climate and situation, we hardly cultivate twenty. The number and excellence of our natural grasses are probably unsurpassed in any quarter of the globe, for a similar extent of country; but this is a department of our natural

history hitherto but partially explored, and we are left mostly to conjecture as to their number and comparative quality. From the health and thrift of the wild animals, the buffalo, deer, etc., as well as the rapid growth and fine condition of our domestic animals when permitted to range over the prairies, or through the natural marshes and woods in every season of the year, even during the severe and protracted winters in latitude 44° north,* the superior richness and enduringness of our natural grasses may be inferred. We shall limit ourselves mostly to those which have been introduced and successfully cultivated in this country.

TIMOTHY, CAT'S-TAIL OR HERDS-GRASS, (*Phleum pratense.*)—We are inclined to place the timothy first in the list of the grasses. It is indigenous to this country, and flourishes in all soils except such as are wet, too light, dry or sandy, and is found in perfection on the rich clays and clay loams which lie between 40° and 44° north latitude. It is a perennial, easy of cultivation, hardy and of luxuriant growth, and on its favorite soil, yields from one and a-half to two tons of hay per acre at one cutting. Sinclair estimates its value for hay, when in seed, to be double that cut in flowers. From its increased value when ripe it is cut late, and in consequence of the exhaustion from maturing its seed, it produces but little aftermath or rowen. It vegetates early in the spring, and when pastured, yields abundantly throughout the season. Both the grass and hay are highly relished by cattle, sheep and horses; and its nutritive quality, in

* The writer has seen large droves of the French and Indian ponies come into the settlements about Green Bay and the Fox river, in Wisconsin, in the spring, in good working condition, after wintering on the natural grasses of that region. The pony grass may perhaps be mentioned as one of the principal of the winter grasses in that region. It grows in close, thick, elevated tufts, and continues green all winter, and is easily detected by animals under the snow, by the little hummocks which everywhere indent its surface. The wild rice which lines the still, shallow waters of the streams and small inland lakes of many of the Western States, affords nutritious forage when green or if early cut and dried; and the grain which is produced in great profusion is an exhaustless store to the Indians who push into the thickest of it, and bending over the ripe heads, with two or three strokes of the paddle on the dry stalks, rattle the grain into their light canoes. The wild ducks, geese and swans which yet frequent those waters, fatten on this grain throughout the fall and winter.

the opinion of practical men, stands decidedly before any other. It is also a valuable crop for seed, an acre of prime grass yielding from fifteen to twenty-five bushels of clean seed, which is usually worth in the market from $2 to $4 per bushel, and the stalks and chaff that remain make a useful fodder for most kinds of stock. It may be sown on wheat or rye in August or September, or in the spring. When sown alone or with other grasses early in the season on a rich soil, it will produce a good crop the same year. From its late ripening it is not advantageously mixed with clover unless upon heavy clays which hold back the clover. We have tried it with the northern or mammoth clover on clay, and found the latter, though mostly in full blossom, still pushing out new branches and buds when the former was fit to cut. The quantity of seed required per acre depends something on the soil and its condition. Eight quarts on a fine mellow tilth is sufficient, and is equal to sixteen on a stiff clay.

THE TALL FESCUE, (*Festuca elatior*,) would appear by the Woburn experiments to yield more nutritive matter per acre when cut in flower than any other grass, cut either in flower or seed. This is a native of the United States, and is best suited to a rich loam. It is not extensively cultivated in this country.

MEADOW FESCUE, (*Festuca pratensis*,) likes a boggy soil, bears well and produces an early grass, much relished by cattle, either green or cured as hay.

SPIKED FESCUE, (*F. loleacea*,) is adapted to a rich loam, and produces the best of hay and pasture.

THE PURPLE FESCUE, (*F. rubra;*) SHEEP'S FESCUE, (*F. ovina;*) THE HARD FESCUE, (F. *duriuscula;*) and THE FLOATING FESCUE, (*F. fluitans;*) are all indigenous to this country, and good pasture grasses.

ORCHARD OR COCK'S-FOOT GRASS, (*Dactylis glomerata*,) is indigenous, and for good arable soils, and especially for such as are shaded, it is one of the most profitable grasses grown. It should be cut for hay before it is ripe, as in seeding it becomes coarse and hard and is less acceptable to cattle. It is ready for

the scythe with the clover, and after cutting, it immediately springs up and furnishes several crops of hay or constant pasturage throughout the season. It should be fed closely to secure a tender, succulent herbage. The seed is remarkably light, weighing only twelve or fifteen pounds per bushel. Twenty to thirty pounds are usually sown upon one acre; yet ten pounds on finely prepared soils have been known to produce a good sod over the entire ground. It flourishes from Maine to Georgia. Its inclination to grow in stools or tussocks, however, is an objection, as a meadow grass.

Smooth-stalked, Meadow, Green, Spear or June Grass, the (erroneously called) Blue Grass of Kentucky, (*Poa pratensis*,) is highly esteemed for hay and pasture. It is indigenous and abounds through the country, and is seen in its highest perfection in strong limestone soils, and particularly in the valleys of the streams west of the Allegany mountains, where it is seen in all its glory. The seed ripens in June and falls upon the ground, where the succeeding rains give it vitality and it pushes out its long, rich slender leaves, one to two feet in height, which in autumn fall over in thick windrows, matting the whole surface with luscious herbage. Upon these fields, which have been carefully protected till the other forage is exhausted, the cattle are turned and fatten through the winter. It maintains its freshness and nutritive properties in spite of frost, and the cattle easily reach it through the light snows which fall upon it. A warm, dry, calcareous soil, seems to be its natural element, and it flourishes only in a rich upland.

Flat-stalked Meadow or Blue Grass, (*Poa compressa*,) is an early dwarfish grass, which abounds in the Middle and Northern States. It is tenacious of its foothold wherever it intrudes. It possesses little merit as hay, but is valuable for pasture, affording as it does a close covering to the ground and yielding much in a small compass.

The Roughish Meadow Grass, (*Poa trivialis*,) has much the appearance of the *poa pratensis*, but its stalk feels rough to the

touch while the other is smooth. It has the further difference of preferring moist or wet loams or clay. It yields well and affords good hay and pasture.

Tall Oat Grass, (*Avena elatior*,) is an early luxuriant grass, growing to the height sometimes of five feet. It makes good hay, but is better suited to pasture. It flourishes in a loam or clay soil.

Meadow Fox-tail, (*Alopecurus pratensis*,) is a highly esteemed grass in England, both for meadows and pastures. It grows early and abundantly, and gives a large quantity of aftermath. It is best suited to a moist soil, bog, clay, or loam. It is indigenous to the Middle States.

Perennial Rye Grass, (*Lolium perenne*,) and Biennial and Italian ditto, are all grasses highly esteemed in Europe, but repeated trials in this country have given no satisfactory results. They yield indifferently with us, and easily winter kill. Careful cultivation under favorable circumstances, may yet acclimate and render them useful grasses.

Fiorin Grass, (*Agrostis stolonifera*,) has been much lauded in England of late, but has made little progress in the estimation of American farmers, and probably with sufficient reason. It is a diminutive grass, affording considerable nutriment in a condensed form, and is adapted to a winter pasture. It grows on a moist clay or boggy soil. Several of the fiorin family abound in this country, among which is the squitch, couch or quick grass.

The sweet scented Vernal Grass, (*Anthoxanthum odoratum*,) is an early, valuable pasture grass, which exhales that delightful perfume, so characteristic of much of the Eastern meadow hay. It is a late as well as early grass, and luxuriates in a dry, sandy loam. It affords two and sometimes three crops in a single season.

Red Top, Herds-grass, Foul Meadow, or Fine Bent, (*Agrostis vulgaris*,) is a hardy, luxuriant grass, loving a very moist soil, and somewhat indifferent as to its texture. It grows luxuriantly under favorable circumstances, and is much relished

by cattle; but by observing farmers it is seldom cultivated where the better grasses will grow. It makes excellent stock hay.

UPRIGHT BENT GRASS, HERDS GRASS OR FOUL MEADOW, (*Agrostis stricta*,) is similar to the foregoing, and by some is deemed only a variety.

AMERICAN OR SWAMP COCK'S-FOOT, (*Dactylis cynosuroides*,) is an indigenous swamp grass, yielding a large amount of grass or hay of inferior quality.

RIBBON GRASS, (*Phalaris Arundinacia*) is the beautiful striped grass occasionally used for garden borders. It has been highly recommended for swamps, where it is alleged that by transplanting, it supercedes all other grasses, and affords a fine quality of hay, of an appearance quite different from the upland growth. The writer tried several experiments both with the seed and roots, on a clay marsh without success. Its proper pabulum is probably a carbonaceous soil, such as is found in an alluvial swamp or peat bed.

GAMA GRASS, (*Tripsacum dactyloides*,) is found growing spontaneously on a naked sand beach in Stratford, Ct., and in other places on our Eastern coasts. It has occasionally been much lauded, but is a coarse, rough grass at the North, and seems not to be highly prized at the South. We have the opinion of some intelligent men in the latter section, that it is utterly worthless for any stock.

BERMUDA GRASS.—This is considered by Mr. Spalding, of Georgia, who examined them both critically from specimens which he raised together, as the *Doub grass of India*, so much commended by Sir William Jones, and so highly prized by the Brahmins. It is by the agriculturists of the South deemed an invaluable grass, yielding four or five tons per acre on good meadow. Mr. Affleck, of Mississippi, states the yield of three cuttings at "five to eight tons per acre on common meadow, that it loses just 50 per cent. of its weight in drying, and is consequently the hardest grass to cut. It is the most nutritive grass known, and to the river planter it is invaluable. There is not a

levee on the banks of the Mississippi which could resist for an hour the pressure and attrition of its fearful flood but for their being bound together with this grass." It loves a warm and moist, but not wet soil.

GRAMA ("*la grama*," or the "grass of grasses,") is held in the highest estimation by the Mexicans. It attains a medium height, and is deemed the most nutritious of the natural grasses in our south-western frontier prairies, in California and parts of Mexico. It grows on dry, hard, gravelly soils, on side hills, the swells of the prairies, and the gentle elevations in the valleys. The principal value is found in the numerous seeds, which are retained in the pods with great tenacity long after they are ripe, serving as a luxurious food for all the granivorous beasts and fowls of the western region.*

THE BUFFALO GRASS is found intermixed with the grama, and seldom grows more than a few inches in height. It forms a thick, soft herbage, on which the traveler walks with ease, and reposes when weary, with delight. It yields a rich sustenance to countless herds of wild cattle, buffaloes, deer, antelopes, etc. This is the great grass of the buffalo ranges of the wide Northwestern plains, and will prove of immense value to the extensive herds of cattle which in the future are to graze those immense regions of country.

There are various other grasses and leguminous plants in our Southern Gulf States, little known as yet, or recently brought to notice, which may prove valuable either in cultivation, or in their natural condition, as found on the wide savannas which spread over the wide ranges of that hitherto but partially explored region. Among these are the

MESQUIT, a popular name, known in Texas, and applied to a variety of grasses, described by Rev. C. W. Howard, in the Patent Office Report for 1860. These are considered highly valuable as grazing forage, and hay. They are described as soft, wavy, and succulent.

* This name is applied to a variety of grasses, of different species, and even of different genera.

The Prairie Grasses are found abundantly in the western prairies and afford large supplies of nutritious food, both as pasturage and hay. As a general rule, however, they are coarse, and easily injured by the early frosts of autumn. Some of the leguminosæ, or wild pea vines, which are frequently found among them, yield the richest herbage. We are not aware that any of these grasses have been cultivated with success.

Tussac Grass, (*Dactylis cespitosa*,) is a luxuriant salt marsh grass, growing in large tufts, and is found in perfection on its native soil, the Falkland Islands, between 51° and 52° south, and about 8° east of the straits of Magellan. Captain Ross describes it as "the gold and glory of those islands. Every animal feeds upon it with avidity, and fattens in a short time. The blades are about six feet long and from two hundred to three hundred shoots spring from a single plant. About four inches of the root eats like the mountain cabbage. It loves a rank, wet, peat bog, with the sea spray over it." Governor Hood, of those islands, says, "to cultivate the tussac, I would recommend that the seed be sown in patches, just below the surface of the ground, and at distances of about two feet apart, and afterwards weeded out, as it grows very luxuriantly, and to the height of six or seven feet. It should not be grazed, but reaped or cut in bundles. If cut, it quickly shoots up; but is injured by grazing, particularly by pigs, who tear it up to get at the sweet nutty root."

Arundo Grass, (*Arundo alopecurus.*)—Mr. Hooker, from the same islands, says, "another grass, however, far more abundant and universally distributed over the whole country, scarcely yields in its nutritious qualities to the tussac; I mean the Arundo Alopecurus, which covers every peat bog with a dense and rich clothing of green in summer, and a pale yellow, good hay in the winter season. This hay, though formed by nature without being mown and dried, keeps those cattle which have not access to the former grass, in excellent condition. No bog, however rank, seems too bad for this plant to luxuriate in; and as we

remarked during our survey of Port William, although the soil on the quartz districts was very unprolific in many good grasses which flourish on the clay slate, and generally speaking, of the worst description, still the Arundo did not appear to feel the change; nor did the cattle fail to eat down large tracts of this pasturage."

We have purposely devoted some space to the description of such new grasses as are indigenous to this continent, and which by their superior value in their native localities would seem to commend themselves to a thorough trial in similar situations elsewhere. There are doubtless others of great merit, which experiment hereafter, will demonstrate to be of singular benefit to the American farmer. The subject of grasses has been but slightly investigated in this country in comparison with their immense importance; and for this reason, with few exceptions, we are at a loss for the true value of the foreign and indigenous grasses to American husbandry.

As an instance of the want of a well established character to some of our cultivated grasses, we quote the opinions of Dr. Muhlenburgh, of Pennsylvania, who has written ably on the subject, and the late John Taylor, a distinguished agriculturist of Virginia, both of whom place *the tall oat grass* (*Avena elatior*,) at the head of the grasses; yet from the investigations made at Woburn, it appears among the poorest in the amount of nutritive matter yielded per acre. Dr. Darlington, also of Pennsylvania, does not mention it, but gives the following as comprehending "those species which are considered of chief value in our meadows and pastures, naming them in what we consider the order of their excellence. 1. Meadow or green grass, (*Poa pratensis.*) 2. Timothy, (*Phleum pratense.*) 3. Orchard grass, (*Dactylis glomerata.*) 4. Meadow fescue, (*Festuca pratensis.*) 5. Blue grass, (*Poa compressa.*) 6. Ray grass, (*Lolium perenne.*) 7. Red top, (*Agrostis vulgaris.*) 8. Sweet scented vernal grass, (*Anthoxanthum odoratum.*")

TABLE OF THE COMPARATIVE PRODUCT AND VALUE OF GRASSES,

as experimented on at Woburn, by Mr. George Sinclair, under the direction of the Duke of Bedford.

BOTANIC AND ENGLISH NAMES OF PERENNIAL GRASSES.	Height in wild state, inches.	Soil employ'd.	When weig'd.	Wt. per acre when green.	Wt. per acre when dried.	Loss in dry'g.	64 dr'ms gave nutritive mat.	Nutrit'e mat. in one acre.	When in flower.	When in seed.	Proportionate value of the grass in flower to the grass in seed.	General character.
				lbs.	*lbs.*	*lbs.*	*d. qr*	*lbs.*			*Fl'r Sd.*	
Anthoxanthum odoratum*—Sweet scented vernal grass, . . .	12	Sandy loam.	In flower.	7827	2103	5723	1 0	122	Apr. 29.	June 21.	4 to 13	Early pasture grass.†
			In seed.	6125	1837	4237	3 1	311				
			L. Math.	6806	....	....	2 1	239				
Holcus odoratus, Host—Sweet scented soft, ...	14	Rich sand loam.	In flower.	9528	2441	7087	4 1	610	Apr. 29.	June 25.	17 to 21	The most nutritive, early grass.†
			In seed.	27225	9528	17696	5 1	2233				
			L. Math.	17015	....	....	4 1	1129				
Alopecurus pratensis—Meadow foxtail, ...	24	Clay loam.	In flower.	20418	6125	14293	1 2	270	May 30.	June 24.	9 to 6	One of the best meadow grasses.‡
			In seed.	12931	5819	7111	1 1	461				
			L. Math.	88167	....	....	2 0	255				
Poa pratensis*—Smooth-stalk mead.	18	Bog earth and clay.	In flower.	10209	2871	7337	1 3	279	May 30.	July 14.	....	Good early hay grass.‡
			In seed.	8507	3403	5104	1 2	199				
			L. Math.	4083	....	....	1 3	111				
Avena pubescens*—Downy oat, .	18	Rich sand loam.	In flower.	15654	5870	9783	1 2	366	June 15.	July 8.	6 to 8	Good pasture grass.†
			In seed.	6806	1361	5445	2 0	212				
			L. Math.	6806	....	....	2 0	212				
Pro trivialis*—Roughish meadow,	20	Manured light loam.	In flower.	7487	2246	5240	2 0	233	June 15.	July 10.	8 to 11	Good on rich moist soils.†
			In seed.	7827	3522	4304	2 3	336				
			L. Math.	4764	....	....	3 0	223				
Agrostis stricta*—Upright bent, .	9	Bog soil.	In flower.	7486	2713	4772	1 2	446	July 28.	Aug. 30.	8 to 5	‡
			In seed.	4764	1310	3454		260				
								47				
Festuca rubra*—Purple fescue, .	12	Light sand.	In flower.	10209	3557	6651	1 2	239	June 20.	July 10.	6 to 8	Good long gr.†
			In seed.	10890	4900	5989	2 0	340				
			L. Math.	30403	....	....	1 2	79				
Festuca ovina—Sheep's fescue, .	6	Light sand.	In flower.	.....	....	....	....	....	June 24.	July 10.	....	Good long gr.
			In seed.	5445	....	....	....	127				
			L. Math.	3403	....	....	....	66				

Dactylis glomerata*—Rough head cock's-foot, ...	24	Rich sand soil.	In flower.	27905	11859	16045	2 2	1089	June 24.	July 14.	5 to 7	A most productive grass, but coarse.†
			In seed.	26544	13272	13272	3 2	1451				
			L. Math.	11910	....	....	1 2	281				
Poa angustifolia—Narrow leaved meadow, ...	24	Brown loam.	In flower.	18376	7810	10566	5 0	1430	June 28.	July 16.	3 to 2	Excellent hay grass.‡
			In seed.	9528	3811	5717	5 1	701				
			L. Math.	.....	....	....	....	....				
Trifolium pratense—Red clover,§	..	T. clay.	In seed.	49005	12251	3675	2 2	1914	July 18.	Aug. 6.	....	‡
Medicago sativa—Lucern, . .	36	Cl. loam.	In seed.	70785	28314	4271	1 2	7659	July 18.	Aug. 6.	....	Best for soil'g.‡
Hedysarum onobrichis—Sainfoin,	..	Cl. loam.	In seed.	8848	3539	5208	2 2	345	July 18.	Aug. 6.	....	
Festuca duriscula*—Hard fescue,	12	Sandy loam.	In flower.	18376	8269	10116	3 2	1004	July 1.	July 20.	14 to 6	Good for hay or pasture.‡
			In seed.	19075	8575	10481	1 2	446				
			L. Math.	10209	....	....	1 1	199				
Festuca pratensis—Meadow fescue,	30	Bog soil.	In flower.	13612	6465	7046	4 2	957	July 1.	July 20.	18 to 6	Excellent for early hay.‡
			In seed.	19057	7623	11435	1 2	446				
Lolium perenne—Perennial rye, .	24	Rich brown loam.	In flower.	7827	3222	4494	2 2	305	July 1.	July 20.	10 to 11	Generally esteemed.†
			In seed.	4492	4492	10481	2 3	643				
			L. Math.	3403	....	....	1 0	53				
Festuca loliacea—Spiked fescue, .	36	Rich brown loam.	In flower.	16335	7146	9188	3 0	765	July 1.	July 28.	13 to 12	Most valuable for hay and pasture.‡
			In seed.	10890	4492	6397	3 1	553				
			L. Math.	3403	....	....	1 1	166				
Avena elatior—Tall oat, . .	50	Brown loam.	In seed.	16335	5717	10617	1 0	255	July 6.	July 28.	....	Good long gr.†
			L. Math.	13612	....	....	1 1	265				
Festuca elatior*—Tall fescue, .	36	Black rich loam.	In flower.	51046	17866	33180	5 0	3988	June 28.	July 16.	20 to 12	Ex. mead. gr.‡
			In seed.	51046	17866	33180	3 0	2392				
			L. Math.	15654	....	....	4 0	978				
Festuca fluitans*—Floating fescue,	18	St. clay.	In flower.	13612	4083	9528	1 3	372	July 14.	Aug. 12.	....	Aquatic grass.
Holcus lanatus*—Meadow soft, .	24	St. clay loam.	In flower.	19057	6661	12395	4 0	1191	July 14.	July 26.	12 to 11	Early and productive.‡
			In seed.	19057	3811	15246	2 3	898				
Poa fertilis—Fertile meadow, .	20	Cl. loam.	In flower.	14973	7861	7111	4 2	1052	July 14.	July 28.	....	An early grass.
Phleum pratense—Meadowcat's-tail,	24	Clay loam.	In flower.	40837	17355	23481	2 2	1595	July 16.	July 30.	10 to 23	Ex. for hay.†
			In seed.	40837	19397	21439	5 3	3669				
			L. Math.	9528	....	....	2 0	297				
Avena flavescens—Yellow oat, .	18	Clay loam.	In flower.	8167	2558	5308	3 3	478	July 24.	Aug. 15.	15 to 9	Valuable grass.‡
			In seed.	12251	4900	7350	2 1	030				
			L. Math.	4083	....	....	1 3	79				
Agrostis vulgaris—Fine bent, .	18	S. soil.	In seed.	9528	4764	4764	1 2	251	July 24.	Aug. 20.	....	An early grass.

* Natives of the United States. † Best cut in seed. ‡ Best cut in flower. § A perennial.

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The sweet scented, soft grass, or holy grass, (*Holcus odoratus*,) according to the Woburn table is next to the tall fescue and timothy in point of nutritive matter to the acre, when cut in seed, and it is placed as far in advance of all others in the value of its aftermath; yet scarcely any other authority mentions it with commendation. Without relying on these experiments as an unerring guide for the American farmer, we append the table on the two preceding pages, as the fullest and most correct we have on the subject, and as affording a useful reference to some of the leading and most valuable of the English grasses, most of which are more or less cultivated in this country.

SOWING GRASS SEED.—As a general rule, grass seeds do best when sown early in the spring, on a fine tilth or mellow soil. If this is done while the frost is leaving the ground, no harrowing will be necessary, as the spring rains wash the seed into the honeycomb left by the frost, and secure to it an early germination. They are also successfully sown in August or September, when the fall rains will generally give them sufficient growth to withstand the effects of the succeeding winter, if the land be free from standing or surface water. It has recently been the practice of many judicious farmers to renovate their old worn out meadows by giving them a coating of unfermented manure, and then turn the sod completely over. On the surface thus plowed, a dressing of well rotted manure or compost with ashes, is spread and thoroughly harrowed lengthwise of the furrows. The seed is then sown and slightly harrowed in, and the decomposing manure with the stubble and roots of the sod give an immediate and luxuriant growth. Grain may occupy the land with the grass seed, but if the latter be sown alone and sufficiently thick, the young plants will exclude the weeds and occupy the soil as profitably as can be done with the grain. There is usually a great deficiency of grass seed sown when permanent meadows or pastures are required. The English method is to mix together and sow on a single acre, without any grain, a bushel or more of various seeds, which are best adapted to the purpose. A quick and full growth

rapidly covers the surface with a rich herbage, surpassing in value that of the best natural pastures or meadows.

The usual method of sowing grass seeds has been by hand, broadcast, and is still a good way, when done by an experienced hand; but it should always be in *still* weather, as wind will blow the seed into unequal portions over the ground. Seed sowers of various kinds have lately been introduced, some one or more of which may be preferable in distributing the seed evenly and more rapidly than by hand sowing. We commend the use of machines in all cases where they are an evident improvement on hand labor.

Lands that should be kept in perpetual grass, are such as are frequently under water, as salt and fresh water meadows; such as are liable to overflow, as the rich bottom or interval lands upon a river bank; heavy tenacious clays, and mountain or steep hillside land, which is peculiarly liable to wash from rains. The low bottom lands generally receive one or more annual dressings from the overflowing waters. The fertilizing matters thus deposited are converted into hay, and become a reliable source for increasing the muck heap for other parts of the farm without demanding anything in return. The thick sward of nutritious grasses which nature has so lavishly supplied to them, is an effectual protection against abrasion and waste from the overflowing water, while the crop, if at any time submerged, can receive comparatively little injury. If plowed, and the fine loose earth is exposed to a sweeping current, much of the soil and all the crop may be lost.

Strong clay lands cannot be properly worked without much labor, unless when under drained and well filled with manure; and they seldom exist in the former condition in this country. Yet these soils, next to the fertile, self-sustaining bottom lands, are the most profitable for the various grasses. When put into this crop, after first clearing off the native growth of wood, the fine vegetable mold at the surface, aided by the magazine of supplies contained in the clay below, gives to them the most certain

and permanent growth. When once plowed this mold is turned under and the intractable clay takes its place on the surface; which, lacking those peculiarities of color, texture and chemical composition, we have before shown are essential to the most successful vegetation, the grass is thin and comparatively unproductive for years. When necessary to break up such lands, they should be thoroughly plowed, and manured on the surface afterwards, evenly laid down, and heavily seeded to grass; and if any deficiency of seed or growth is manifested they should receive an addition of seed with a compost dressing.

The injury to plowing steep side hills is sufficiently apparent, as not only the soluble matters, but many of the finer particles of the soil are washed out and carried far beyond reach. Such lands should be kept in permanent pasture if not suitable for mowing. If fed off by sheep, they drop most of their manure on the higher points which is partially washed down and sustains the fertility of every part. There is still another class of lands that should not be broken up for meadows. These are such as are filled with small stones, from the surface of which they have been cleared, but which plowing and harrowing will again bring to it and there leave a perpetual annoyance to the mower.

The Means of Renovating Permanent Meadows and Pastures.—The general theory adopted in regard to pasture lands, is that they are manured sufficiently by the animals feeding on them. This opinion is only partially correct. Pastures wear out less than other lands, but when milk cows and working animals are fed upon them, they carry off much of the produce of the soil which is never again returned to it. Even the wool and carcass of sheep, with the ordinary escape of the salts by the washing of the rains, will, after a long time, impoverish the land. How much more rapidly when much of the manure and all the milk, which is rich in all the elements of plants, is daily carried from the soil. To such an extent have the permanent clay pastures of Cheshire (in England,) been impoverished, that it has been found necessary to manure them with crushed bones, which

at once brought up their value more than 100 per cent. There is much phosphate of lime in milk, and bones which are mostly of the same material are the best manure that could be used for dairy pastures. Wool contains a large proportion of sulphur, and sulphate of lime (gypsum) becomes a proper manure for sheep pastures; but whatever has a tendency to develop vegetation, will generally accomplish the object by yielding all the needful properties. Ashes and salt are of the highest value for pasture lands, and with the addition in some instances of lime, bones and gypsum, are all that would ever be necessary for permanent pastures. From the peculiar action of these, instead of growing poorer, *pastures may become richer through every successive year.*

Permanent meadow lands, if constantly cropped without manures, may be exhausted with much greater rapidity than pastures, though this depreciation is much more gradual than with tillage lands. There is no greater mistake than to suppose they will keep in condition by taking off one annual crop only, and either pasturing the aftermath or leaving it to decay on the ground. By recurring to the table of the ash of plants, it will be seen that the analysis of hay there given shows over five per cent., while dried clover yields from seven to nine per cent., of earthy matter. Every particle of this is essential to the success of the plant, and yet if the land produces at the rate of three tons per acre, they are taken off to the amount of upwards of 300 pounds per annum. No soils but such as are periodically flooded with enriching waters, can long suffer such a drain with impunity. *They must be renewed with the proper manures, or barrenness will ensue.* Ashes, lime, bones and gypsum, (the latter especially to be applied to clovers, its good effects not being so marked on the grasses,) are essential to maintain fertility, and to insure the greatest product, animal or vegetable manures must also be added. The proper manner of applying these fertilizers is by scattering them over the surface when the grass is just commencing a vigorous growth in spring, or simultaneously with the first rains after mowing. The growing vegetation soon buries them under its

thick foliage, and the refreshing showers wash the soluble matters into the roots; and even the gases that would otherwise escape, are immediately absorbed by the dense leaves and stalks which everywhere surround it. The loss of any kind of manure is trifling, even in a state of active decomposition, when scattered broadcast under such circumstances.

Pasturing Meadows.—There is no objection to feeding off meadows in early autumn, while the ground is dry and the sod firm. The roots of the grass are rather benefited than injured by the browsing and the land is improved by the droppings from the cattle, and more particularly by sheep. But they should never be pastured in spring. It is economy to purchase hay at any price rather than to spring-pasture meadows.

Rotation on Grass Lands.—Most soils admit of a profitable rotation or change of crops, and where this is the case, it is generally better to allow grasses to make up one of the items in this rotation. Where these are successfully grown in permanent meadows, this change or breaking up is less to be sought on their own account than for the other crops, which do better for having a rich fresh turf to revel in. Thus, potatoes are sounder, better, and yield more on turf than on old plowed ground; and the grain crops are generally more certain and abundant than on other lands. But there are many of the light soils which retain the grasses only for a short time. These should be placed in a rotation which never assigns more than two years to grass.

Time for Cutting Grass.—This must depend on the kind of grass. We have seen that timothy affords nearly double the quantity of nutriment in seed that it does in its early flower, and it is then much more relished by stock. Timothy, therefore, should never be cut except when the seed is formed. The proper time is when it is between the milk and dough state, and will nearly ripen after cutting. Orchard grass, on the other hand, although it possesses two-sevenths more nutritive value for hay in the seed, yet as it is more tender and preferred by stock when

cut in the flower, and as it continues to grow rapidly afterwards, should be always cut at that time.

CURING GRASS.—Many farmers do not consider the scorching effects of our cloudless July suns, and the consequence is that hay is too much dried in this country. Unless the crop be very large, grass will generally cure sufficiently when exposed in the swath for two days. When shook or stirred out, it should not remain in this condition beyond the first day, as it will lose much of its nutritive juices; nor should dew or rain be permitted to fall upon it unless in cocks. It is better, after partially drying, to expose it for three or four days in the cock. Hay should go into the barn or stack, not crisp and dry, but slightly soft and moist in its own juices, and as soon as properly cured place it under cover.

THE MOWING MACHINE.

This wonderful improvement in the hay harvest is now in such general use, and so widely distributed throughout the country, that they need be only alluded to in recommending the use of them on all lands where they can be worked; and the competition in the manufacture and sale of the various patterns is so brisk that no farmer need be at a loss in his selection. Happily, in order to use the machine, the farmer has been compelled to smooth his meadows by freeing them from stones and other obstructions, and rolling their surfaces—an improvement to the product of the grass as well as to the facility of working them.

THE HAY TEDDER, OR SPREADER.

When the crop is heavy, the labor of curing it has been greatly facilitated and cheapened by the use of the different kinds of hay tedder, or spreader, worked by horse power, lately invented and brought into use. With light crops—a ton or so to the acre—it is not so much needed; but with heavy crops, needing to be turned over for drying, it is, at present prices for labor, indispen-

sable. The work can thus be done in fair weather in one-half or one-quarter the time it would take by hand labor.

THE HORSE RAKE.

This implement is indispensable on all meadows where they can be worked. There are various patterns of these, as the revolving flat rake, and the wheel sulky, or wire spring tooth implement, with a seat and hand governor for the driver, the latter of which we prefer for rapid and easy work. They rake clean, and enable the grass to be thrown into large windrows, where, when raked partially green, it will cure equally well in dry weather as when in cock. But if the weather be *catching*, it is better to put it up in well rounded cocks.

THE HORSE HAY FORK.

This article has of late come in use where large hay harvests are to be secured. There are several varieties, and most of them good. They save a deal of severe hand labor, and much time in storing the hay. The *manner* of their use is readily understood and fully explained wherever the implement is to be purchased.

The hay knife, for cutting down mows and stacks, and forks for pitching, are too familiar to need remark, only that they be of the best. A reference to the implement catalogues of our manufacturers and dealers will supply all the information necessary on these several matters.

THE CLOVERS,

Sometimes improperly called grasses, are botanically arranged in the order, *leguminosæ*, under the same head with the bean, pea, locust, vetches, etc. More than 160 species of clover have been described by naturalists. Their properties and characteristics are totally unlike the grasses, with which they agree only in their contributing in a similar manner to the support of farm stock. There are many varieties cultivated abroad, but the

attention of farmers in this country has been limited to a very few.

The Common Red or Northern Clover, (*Trifolium pratense*,) a biennial, and occasionally on calcareous soils, a triennial, is the species most generally in use in the United States. This is a hardy, easily cultivated variety, growing luxuriantly on every properly drained soil of sufficient strength to afford it nutriment. It has numerous strong well developed stems, branching outwardly and vertically from a single seed, and bearing broad thick leaves which are surmounted by a large reddish purple flower. By the analysis of Davy, the whole plant yields an amount of nutritive matter fully equal to any other of the clovers.

Mode of Cultivation.—Clover may be sown broadcast either in August or September, but much better and surer early in the spring, with most of the cereal grains, or the cultivated grasses; or it may profitably constitute a crop by itself. The quantity of seed required per acre depends on the kind of soil. On well prepared loams, ten or twelve pounds of good seed will frequently give a full covering to the land, while on clay twelve to sixteen pounds are necessary per acre. When sown with the grasses, four to six pounds on the first, and eight to twelve pounds on the last soil will suffice. An additional amount of seed, as with the grasses, will give a finer quality of hay in consequence of multiplying the number of stalks; and for this purpose, as well as to insure it on every spot of the field, it should always be liberally sown. The covering, like that of grass seeds, should be of the slightest kind; and when sown very early in the spring, or on well pulverized grounds, and followed by rains, it will germinate freely without harrowing. After the leaves are developed in the spring, an application of gypsum, on lands which are amenable to its favorable action, should be made by sowing broadcast, at the rate of one to three or four bushels per acre. The effect of this on clover is singularly great, and it seems to be augmented by applying it on the leaves. This may perhaps be accounted

for in the fact, that besides its other uses, gypsum yields a considerable proportion both of its sulphuric acid and lime to the plant, and thus constitutes a direct food. The influence of gypsum is almost incredible in developing the clovers on fields where they were hardly discernible before. This may be witnessed in almost any soil where gypsum has any effect. By sowing a quantity over the grass plat containing either the seeds or plants of the clover, however thin or meager they may be, an immediate and luxuriant growth distinguishes the spot which has received it from all the surrounding field. Bones are invaluable manure for the clovers. The table of the ashes shows the great quantity of lime and phosphoric acid (the leading elements of bones,) which the clovers contain in comparison with the rye grass, which is a type of the other grasses. Thus the red clover has about four times as much lime, twenty-six times as much phosphoric acid, more soda and sulphuric acid, and nearly twice and a half as much potash as the grass. The white clover has about four times the potash; the lucern nearly seven times the lime, and fifty-two times the sulphuric acid contained in the grass.

Such are the various demands of plants and the necessity of providing each with its specific food. And hence the advantage of cultivating a variety of grasses and clover on the same spot. Each, it is true, draws its nutriment from the same elements, but in such unlike proportions that when they cease to yield adequate support to one, the soil may still be rich in those which will give luxuriant growth to others. Thus two or more of the forage plants when growing together may each yield a large crop, swelling the aggregate product far beyond what would be realized in the separate cultivation of either. This is one of the instances, and it is sufficiently satisfactory, of the utility of good husbandry in the cultivation of the mixed grasses and forage.

Time for Cutting and Mode of Curing Clover.—Clover should be cut after having fully blossomed and assumed a brownish hue. By close cutting, more forage is secured and the clover afterward springs up more rapidly and evenly. The swath, unless very

heavy, ought never to be stirred open, but allowed to wilt on the top. It may then be carefully turned over, and when thus par tially cured, placed in high slender cocks and remain till sufficiently dry to remove into the barn. The clover may be housed in a much greener state by spreading evenly over it in the mow from ten to twenty quarts of salt per ton. A mixture of alternate layers of dry grass hay, or straw with the clover, by absorbing its juices, answers a better purpose, while it materially improves the flavor of the straw for fodder.

After-management of Clover fields.—The second crop of clover may be either saved for seed, mown, pastured, or turned under for manure. As this is usually a biennial when allowed to ripen, the stocks die off after the second year, unless its seeding has been prevented, and the crop is only partially sustained by the seed which may have germinated the second year from the first sowing, or from such as has been shed upon the surface from the seed matured on the ground. The maximum benefit derivable to the soil in the manure of the stubble and roots, is attained the second year, as we have seen that the dried roots of the clover at that time are in the proportion of fifty-six for every one hundred pounds of clover hay produced from them in two years. But the ground is then so full of the roots as to check further accumulation. This then is the proper time for plowing up the field and renewing again its accustomed round of crops. If desirable, the clover may be imperfectly sustained on some soils for a few years by the addition of gypsum, bone dust, ashes and other manures, which will develop and mature the ripened seeds, but the greater tenacity of other plants and grasses will soon reduce it to a minor product in the field.

The above remarks apply to soils generally used in clover, when intended for a rotation of crops. But the retention of red clover in upland permanent meadows is frequently surprising. We have known it, either with or without occasional top dressings of manure, to hold in the ground with wonderful tenacity, quite equal to the timothy and other grasses with which the land is

more generally clothed. It does not appear in every year alike. Some years little, or none of the clover will be seen; in other years, it will make a considerable portion of the crop. It has so proved in our own upland meadows. We have a home lot which has never been plowed. It has for fifty years past been occasionally top dressed with barn manures, and the red clover in it has alternated more or less ever since we have known it. The lot has always been mown for hay, and fed off during the autumn afterwards.

It is of little use to expect clover as a permanent crop in wet soils, or those subject to *heave* by the annual winter frosts. The roots are long, penetrating deep in the ground, and the *heaving* of the frost breaks off or draws out the roots, which destroys the coming crop. We have seen a fresh clover lay so drawn out by the previous winter frost as to be raked off in the spring, roots and all, utterly worthless. Yet, when only *partially* drawn out, the application of a heavy roller on the land early in the spring, may so pack them down that a tolerable crop may be gathered. In order to make sure crops of clover, wet lands should be under drained. So, also, should those liable to be heaved by the winter frosts.

Importance of the Clovers.—The great value of the different clovers as forage was well known to the ancients. They were largely cultivated by the early Romans, and since that period they have been extended throughout a large part of Europe. They were not introduced into Great Britain till the sixteenth century, but have since constituted a profitable branch of husbandry. Their importance has long been acknowledged in the United States. The nutritive matter, although relatively less than from some of the grasses, is yet in the amount per acre, fully equal to the average of any other forage crop which is produced at the same expense, and, when properly cured, is a most valuable food for milk cows, calves and sheep. It is early and cheaply raised, it is liable to few or no casualties or insect enemies in this country, and its long tap roots are powerful auxiliaries in the division and

improvement of soils. Its broad, succulent leaves derive a large portion of their nutriment from the atmosphere, and thus, while it affords a product equal to the best grasses, it draws a large part of it from the common store house of nature, without subjecting the farmer to the expense of providing it in his manures.

It is as a fertilizer, however, that it is so decidedly superior to other crops. In addition to the advantages before enumerated, the facility and economy of its cultivation, the great amount yielded, and lastly, the convenient form it offers for covering with the plow, contribute to place it far above any other vegetable. All the grains and roots do well after clover, and wheat, especially, which follows it, is more generally free from disease than when sown with any other manure. The introduction of clover and lime in connection, has carried up the price of many extensive tracts of land from $25 to $100 per acre, and has enabled the occupant to raise large crops of wheat where he could get only small crops of rye; and it has frequently increased his crop of wheat three-fold where he had before produced it.

It is a common observation of intelligent farmers, that they are never at a loss to renovate such lands as will produce even a moderate crop of clover. Poor clay lands not capable of bearing it, have become so by sowing an early and late crop of oats in the same season and feeding them off on the ground. Poor sandy soils may be made to sustain clover with manure, ashes and gypsum, combined with the free use of the roller. This object is much facilitated by scattering dry straw over the surface, which affords shade, increases the deposit of dew and prolongs its effects. Whenever the period of clover-producing is attained, the improvement of the soil may be pushed with a rapidity commensurate with the inclination and means of the owner. To show the comparative estimate which many experienced farmers place on red clover as a fertilizer, some years ago in passing the road by a large distillery on the elevated bank of a creek running into the Scioto river, in Ohio, we saw the pens, in which a large

number of swine were fed from the "slops" of the distilled grain, so placed that the offal from them was thrown out and passed down the declivity immediately into a stream below, to flow off and enrich the drinking water of the good people inhabiting the cities along the great rivers of Ohio and Mississippi. The premises were owned by a large farmer, whose land surrounded for a wide distance this waste-enduring process. He was on the ground as we passed,—a robust, intelligent, well-to-do person age—and we asked him why he did not build his pens so that the manure could be removed and spread on the land, where it would be so valuable to him? "Why, sir," he replied, "it is of no sort of consequence. *I really cannot afford it.* One good crop of clover, plowed in, is worth more to the land than all the hog manure I can haul on to it." It may be so, thought we, but if the farm were our own, the manure should go on to it, notwithstanding.

Mr. George Geddes, living near Syracuse, N. Y., has stated publicly that the farmers, including himself, in his vicinity, whose farms are situated on the "Onondaga lime group," and "Marcellus Shales," although they carefully save and use all the manure made on their farms, would not draw barn manure a mile, if it were given to them. They prefer clover, plowed in, although they raise wheat largely as well as other cereals, and their land has been constantly worked for more than seventy years. How general this opinion and application may be, we do not know; but it is at least fortunate that in many localities the practice has been so successful. The hint may be possibly adapted to very many, as yet, untried places.

Harvesting Clover Seed may be done generally after taking off one crop, or pasturing the field till June, or at such time as experience shows to be the proper one for leaving it to mature a full crop of seed. Early mowing removes the first weeds, and the second growth of the clover is so rapid as to smother them and prevent their seeding, and the clover is thus saved comparatively clean. It is then mown and raked into very

small cocks, and when dried at the top they are turned completely over without breaking, and as soon as thoroughly dried they may be carried to the threshing floor and the seeds beaten out with sticks, light flails, or much better, with a threshing machine. An instrument with closely set teeth and drawn by a horse, is sometimes used for collecting the clover heads from the standing stalks from which the seed is afterwards separated. If wanted for use on the farm, these heads are sometimes sown without threshing. The calyx of the clovers is so firmly attached to the seed as to be removed with difficulty, but if thrown into a heap after threshing, and gently pressed together, a slight fermentation takes place and the seed is afterwards readily cleaned. A fan or clover machine may be used for cleaning the seed for market. The produce is from three to six bushels per acre, which is worth to the farmer from $5 to $8 per bushel of sixty pounds.

SOUTHERN CLOVER, (*Trifolium medium*,) is a smaller species than the *Trifolium pratense*, and matures ten or fourteen days earlier, and the soil best suited to it is nearly similar. It does better on a light thin soil than the larger northern, and should be sown thicker. Strong clay or rich loamy soils will produce much heavier crops of the larger kind. Experience alone will determine which of these kinds should be adopted under all the circumstances of soil, fertility, etc.

WHITE CREEPING CLOVER, (*Trifolium repens.*)—There are several varieties of white clover, all of which are hardy, nutritious and self-propagating. Wherever they have once been, the ground becomes filled with the seed, which spring up whenever an opportunity is afforded them for growth. They are peculiarly partial to clay lands having a rich vegetable mold on the surface, and the addition of gypsum will at all times give them great luxuriance. Their dwarf character renders them less fit for the scythe than the red clovers, while the dense matted mass of sweet rich food ever growing and ever abundant, makes them most valuable for pasture herbage.

THE YELLOW CLOVER, HOP TREFOIL OR SHAMROCK, (*Trifolium procumbens,*) like the white, is of spontaneous growth, very hardy and prolific. It bears a yellow flower and black seeds. It is one of those unostentatious plants, which though never sown and little heeded, help to make up that useful variety which gives value and permanence to our best pasture lands.

MANY OTHER OF THE MINUTE CLOVERS AND LEGUMINOSÆ, THE WILD PEA, ETC., abound in our untilled lands, and add much to the value of the forage, although their merits and even their existence are scarcely known.

CRIMSON OR SCARLET CLOVER, (*Trifolium incarnatum,*) is a native of Italy, and much cultivated in France. It bears a long head of bright scarlet flowers, and in Southern Europe is a profitable crop. Although it was introduced into this country many years since, it has not hitherto commended itself to particular attention as an object of agriculture.

LUCERN, (*Medicago sativa,*) is one of the most productive plants for forage ever cultivated. It was extensively cultivated by the Greeks, and other nations of antiquity, for many centuries, and it has been a prominent object of attention in Italy, Spain, France, Holland and Flanders. Its relative value, as compared with clover, (*T. pratense,*) is decidedly inferior, while its absolute value per acre, is much greater. It was early introduced into this country. Chancellor Livingston published his experiments with it in 1791 to 1794, by which he estimates that he cut in one season, at the rate of six and one-fifth tons per acre in five cuttings, yielding a profit of over $35 an acre. It bears from three to five crops per annum, containing from three to eight tons of hay. Those who have cultivated it pronounce it hardy, and as capable of successful growth in this country as clover, but to reach the highest product, it requires a richness of soil, and carefulness of cultivation, which would give an enormous produce to its more humble rival. Our climate in the Northern and Middle States is too cold for it.

Manner of Cultivation.—It must have a deep, dry, loamy soil, free from weeds, and well filled with manure. A suitable crop

to precede it is corn or potatoes, heavily manured, and kept clean Plow in the fall, and add forty bushels crushed bones per acre; and early in April, harrow thoroughly, and sow in drills from one to two and a half feet apart, at the rate of eight or ten pounds of seed per acre. Stir the ground and extirpate the weeds with the cultivator or horse and hand hoe. It may be lightly cropped the first year, and more freely the second, but it does not attain full maturity till the third. The roots strike deep into the ground, and being a perennial, it requires no renewal, except from the loss of the plants by casualties. It should be cut before getting too heavy, and cured like clover. Liquid manure is good for it, as are also gypsum and ashes. Barn-yard manure is occasionally necessary, but to avoid weeds, it must be thoroughly fermented to destroy all the seeds. It is sometimes sown broadcast, but the rapid progress of weeds, grass, etc., in the soil will soon extirpate it if they are suffered to grow; and there is no other means of effectually eradicating them but by cultivating the lucern in drills, and the hoe and cultivator can then keep the weeds in subjection. It is one of the most valuable plants for soiling. From the care and attention required, the cultivation of lucern is properly limited to an advanced state of agriculture and a dense population, where labor is cheap and products high. In the neighborhood of large cities it may be advantageously grown, and in all places where soiling is practiced.

SAIN-FOIN, (*Hedysarum onobrychis,*) the *esparcette* of the French, is a native of the chalk soils of Europe, and is adapted only to strong calcareous lands. On such it is a valuable herbage, as the roots penetrate to a great depth and yield large burdens of nutritious fodder. Though often attempted, we are not aware that it has been raised to any extent in this country. Our winters are too severe for it.

BOKHARA OR SWEET SCENTED CLOVER, (*Melilotus major,*) is a tall, shrub-like plant, growing to the height of four to six feet, with branches, whose extremities bear numerous small white flowers of great fragrance. When full grown it is too coarse for

forage, but if thick and cut young it yields a profusion of green or winter fodder. It should be sown in the spring with about two pounds of seed per acre, in drills sixteen to twenty inches apart; it must be kept clear of weeds and cultivated like lucern. It requires a rich, mellow, loamy soil. We are too cold for it, also. There are some other plants which might probably be introduced into American husbandry for forage with decided advantage. Among these is

SPURRY, (*Spergula arvensis.*)—It is a hardy plant which grows spontaneously in the Middle States. Its chief merit consists in its growing on soils too thin to bear clover. On such it can be well used to bring them up to the clover bearing point, from which they can be taken and carried forward much more rapidly by the clovers. Van Voght says, "it is better than red or white clover; the cows give more and better milk when fed on it, and it improves the land in an extraordinary degree. If the land is to lie several years in pasture, white clover must be sown with it. When sown in the middle of April, it is ripe for pasture by the end of May. If eaten off in June, the land is turned flat and another crop is sown, which affords fine pasture in August and September. This operation is equivalent to a dressing of ten loads of manure per acre. The blessing of spurry, *the clover of sandy lands*, is incredible when rightly employed." Three crops can be grown upon land in one season, which if turned in or fed on the ground, can be made a means of rapid improvement.

PASTURES.

It is too often the case, that pastures are neglected, and like woodlands, are allowed to run to such vegetation as unassisted nature may dictate. As a necessary consequence, their forage is frequently meager and coarse, and incapable either in quantity or quality of supporting half the number of cattle in poor condition, that might otherwise be full fed from them. But if we consider that pastures furnish most of the domestic stock with their only food for seven months of the year at the North, and generally for

ten months at the South, and many localities the year round, they may well be deemed worthy the particular attention of the farmer.

Pastures ought to be properly divided; and it is perhaps a diffi cult point to determine between the advantage of small ranges, and the expense and inconvenience of keeping up numerous divisions. The latter requires a large outlay on every farm, not only for the first cost of material and annual repairs, but from the loss of land occupied by them; and they are further objectionable from their harboring weeds and vermin. Yet it is beneficial, sometimes, to give animals a change of feed, and the grass comes up evenly and grows undisturbed, if the cattle be removed for a while. There is a further advantage in being able to favor some particular individuals or classes of animals. Thus, fattening stock, milk cows, and working animals, ought to have the best feed; then young stock; while sheep will thrive on shorter feed than either, and greedily consume most plants which the others reject. By this means a field will be thoroughly cleansed of all plants which animals will eat, and the remainder should be extirpated. The same care should be taken to prevent the propagation of weeds in pastures as in other fields. Many of these, mullen, thistle, and the like, multiply prodigiously from sufferance, and if unchecked will soon overspread the farm.

Every pasture should, if possible, be provided with running water and shade trees, or other ample protection against a summer's sun. The last can at all times be secured by a few boards supported on a light, temporary frame. Excessive heat exhausts and sometimes sickens animals, and consequently it materially diminishes the effects of food in promoting their secretion of milk, the growth of wool, flesh, etc. Pastures ought to be protected against poaching, or treading up in the spring or late in the autumn. All grounds, immediately after long and late rains in the fall, or the winter's frosts, are liable to this when exposed to the hoofs of cattle, particularly clay lands and such as have been recently seeded. On late, and off early, is a good rule to be

adopted for spring and fall pasturing. Wherever the grasses disappear, fresh seeds should be added and harrowed in; mosses should be destroyed; they should be properly drained, and every attention paid to them that is bestowed on the mowing lands, except that they seldom require manures. But ashes, gypsum, lime, etc., may frequently be applied to them with great profit. Pastures should take their course in rotation when they get bare of choice herbage or full of weeds, and it is possible to break them up advantageously. Though many choice, natural forage plants may thus be destroyed, yet if again turned into grass at the proper period, and they are sown with a plentiful stock of assorted grass seeds on a rich and well prepared surface, they will soon place themselves in a productive state.

In *natural* grass lands, which have a *good* natural, or even an artificial drainage, pastures should very rarely, or never be broken up. The older they are, the better, as a rule. They become filled with a large variety of grasses, all nutritious and valuable in their seasons, and when once broken up, it will take many years, even if well re-seeded, to firmly establish them again. There are pastures in the old grazing and dairy districts of England that have not been plowed for centuries, and are still better than new ones. In many portions of this country, such is also the case.

The treatment of pastures must, of necessity, differ largely in various parts of our country, depending upon the surface of the land, the passage of large rivers with wide interval, or bottom land, the kind of stock to which they are devoted, the density or sparseness of the population inhabiting them, and the circumstances and habits of the people.

We are not partial to small enclosures of any kind, either for cultivated crops, or those devoted to pasturage alone. Yet small farms must have smaller fields than large ones, where stock run out in the grazing season. Fencing is expensive; therefore the less of it the better. Road fences, particularly in districts where cattle are permitted to run at large on the highways, must

be both high and strong; and so must fences in the divisions of farm fields where horses, mules, and steers, or oxen are largely pastured. It is still a divided question as to the benefit of frequently changing pastures for stock.

As we increase in population, and land becomes more valu able, "soiling," as in Europe, and now to some extent in Amer ica, must become a part of our farm system, and the various economies connected with it a subject for study and practice with all who intend turning their acres to the best advantage.

CHAPTER VII.

GRAIN AND ITS CULTIVATION

WHEAT, (TRITICUM.)

This is one of the most important and most generally cultivated of the cereal grains, (or grasses as they are botanically termed,) though both rice, and maize or Indian corn, contribute to the support of a larger population. It is found in every latitude excepting those which approach too nearly to the poles or equator, but it can be profitably raised only within such as are strictly denominated temperate. Linnæus describes only six varieties, but later botanists enumerate about thirty, while of the sub-varieties there are several hundred. The only division necessary for our present purpose is of the winter wheat, (*Triticum hyburnum*,) and spring or summer wheat, (*Triticum æstivum.*) The former requires the action of frost to bring it to full maturity and is sown in autumn. Germination before exposure to the frost, does not, however, seem absolutely essential to its success, as fine crops have been raised from seed after having been saturated with water and frozen for some weeks, and sown early in spring. It has also been successfully raised when sowed early in the season and while the frost yet occupied the ground. Spring and winter wheat may be changed from one to the other by sowing at the proper time through successive seasons, and without material injury to their character. The winter grain is by far the most productive, the straw is stouter, the head more erect and full, the grain plumper and heavier, and the price it bears in market from ten to twenty-five per cent. higher than that of

spring wheat. This difference of price depends rather on the appearance of the flour and its greater whiteness, than on any intrinsic deficiency in its substantial qualities. The analysis of Davy gave in 100 parts, of

	Gluten.	Starch.	Insoluble matter.
Spring wheat of 1804,	24	70	6
Best Sicilian winter wheat,	21	74	5
Good English winter wheat of 1803,	19	77	4
Blighted wheat of 1804,	13	53	34

This analysis gives the greatest nutritive value to the spring wheat, as the gluten constitutes the most important element in flour, resembling so nearly as it does animalized matter. It will also be noticed that the Silician yields about two per cent. more gluten than the English, which enables the flour to absorb and retain a much larger proportion of water when made into bread. This is what is termed by the bakers, *strength;* and when gluten is present in large proportions, other qualities being equal, it adds materially to the value of flour. American wheat also contains more gluten than English, and that from the Southern States still more than that from the Northern. An eminent baker of London says American flour will absorb from eight to fourteen per cent. more of its own weight of water when manufactured into bread or biscuit than their own; and another good authority asserts, that while fourteen pounds of American flour will make twenty-one and a half pounds of bread, the same quantity of English flour will make only eighteen and a half pounds. As a general rule, the dryer or hotter the climate in which the grain is raised, the greater is the evaporation and the more condensed is the farina of the grain, and consequently the more moisture it is capable of absorbing when again exposed to it. Certain varieties of wheat possess this quality in a higher degree than others. Some manures and some soils also give a difference with the same seed, but for ordinary consumption, the market value (which is the great consideration with the farmer,) is highest for such wheat as gives the largest quantity of bright flour, with a due proportion of gluten. Other prominent differences exist among

the leading cultivated varieties of wheat, such as the bearded, and bald or beardless, the white and red chaff, those having large and strong stalks, or a greater or a less tendency to tiller, or to send out new stems, etc., etc. There is great room for selection in the several varieties, to adapt them to the different soils, situations, and climate for which they are designed.

Preparation of the Land for Sowing.—Wheat is partial to a well prepared clay or heavy loam, and this is improved when it contains either naturally or artificially a large proportion of lime. Many light, and all marly or calcareous soils, if in proper condition, will give a good yield of wheat. Lime is an important aid to the full and certain growth of wheat, checking its exhuberance of straw and its liability to rust, and steadily aiding to fill out the grain. A rich mellow turf or clover lay is a good bed for it; or land which has been well manured and cleanly cultivated with roots or corn the preceding season. Fresh barn-yard manure applied directly to the wheat crop, is objectionable, not only from its containing many foreign seeds, but from its tendency to excite a rapid growth of weak straw, thus causing the grain both to lodge and rust. The same objection lies against sowing it on rich alluvial or vegetable soils; and in each, the addition of lime or ashes, or both, will correct these evils. A dressing of charcoal has in many instances been found an adequate preventive; and so beneficial has it proved in France that it has been extensively introduced there for the wheat crop. A successful example of uninterrupted cropping with wheat through several years, has been furnished by a Maryland farmer, who used fresh barn-yard manure with lime. But this is an exception, not a rule, and it will be found that profitable cultivation requires that wheat should take its place in a proper rotation. The great proportion of silica in the straw of cereal grains, (amounting in wheat, barley, oats and rye, to about four-fifths of the total of ash from the grain and straw,) shows the necessity of having ample provision made for it in the soil in a form susceptible of ready assimilation by the plant. This is afforded both by ashes, and from the action of lime upon the soil.

Depth of soil is also indispensable to large crops. The wheat plant has two sets of roots: the first springing from the seed and penetrating downwards, while the second push themselves laterally near the surface of the ground from the first joint. They are thus enabled to extract their food from every part of the soil, and the product will be found to be in the ratio of its extent and fertility. Under draining and subsoil plowing contribute greatly to the increase of crops, and it is essential that any surface water be entirely removed. Wheat on heavy clay lands is peculiarly liable to winter kill unless they are well drained. This is owing to successive freezing and thawing, by which the roots are broken or thrown out. When this is done to a degree that will materially diminish the crop, the naked spots may be sown with spring wheat. Any considerable portion of the latter will lessen the value for sale, but it is equally good for domestic use. The land should be duly prepared for the reception of the seed by early and thorough plowing, clod crushing, rolling and harrowing, if necessary.

Selection and Preparation of Seed.—Many persons select their seed by *casting* or throwing the grain to some distance on the floor, using only such as reaches the farthest. This is a summary way of selecting the heaviest, plumpest grain, which, if Sprengel's theory be correct, is attended with no advantage beyond that of separating it from the lighter seed of chess or weeds. It is certain that the utmost care should be taken in removing everything from it but pure wheat, and this should be exclusively of the kind required. When wheat is not thoroughly cleaned by casting, a sieve or riddle should be used, or it should even be picked over by hand, rather than sow anything but the pure seed. Previous to sowing, a strong brine should be made of salt and soft water, and in this the grain should be washed for five minutes, taking care to skim off all light and foreign seeds. If the grain be smutty, this washing should be repeated in another clean brine, when it may be taken out and intimately mixed with one-twelfth its bulk of fresh pulverized quicklime.

This kills all smut, cleans out weeds from the grain, and ensures early, rapid growth. When the seed is not smutty, it may be prepared by soaking or sprinkling it with stale urine and afterwards mix with the lime; and if well done this also will prevent smut, though the first is most certain. (See "varieties of seed' following, for further directions.)

QUANTITY OF SEED AND TIME OF SOWING.—On well pulver ized, ordinary wheat soils, about five pecks of seed is sown to the acre, while rough land, clay soils, and such as are very fertile, require from six to eight. In Maryland, but three pecks are frequently sown to the acre, and some of the best crops have been raised from only two pecks of seed on a finely pulverized soil. It takes more seed when full and plump than when shrunken, as there may be nearly two of the latter to one of the former in the same measure. A difference is to be observed according to the kind of wheat, some needing more than others. A larger quantity of seed produces an earlier growth of lighter straw and head, but does not usually increase the aggregate crop. There is always a tendency in wheat and most of the cereal grasses, to tiller or send out new shoots for future stalks. This is a law of these plants, which compels them to make the greatest effort to cover the whole ground, and sometimes a single seed will throw out more than a hundred stalks. In early sowing, the wheat tillers in the autumn; in late sowing, this is done in part only till the ensuing spring. Thick sowing is a substitute for tillering to the extent that would otherwise be induced, and is equivalent to earlier sowing of a smaller quantity. The time for sowing in our Northern States is from the tenth to twentieth of September. If sown earlier, it is liable to attack from the Hessian fly, and if later, it does not have time to root as well, and is in more danger of being thrown out by the frost or of winter killing. Late sowing is also more subject to rust the following season from its later ripening.

SOWING.—When the ground has been well mellowed, the seed may be sown either broadcast or in drills—but drilling is much

the better way, by distributing the seed more evenly, as well as by a considerable saving in the quantity of seed—and thoroughly harrowed in. Rolling is a good practice, as it presses the earth closely upon the seed and facilitates germination, and as soon as the seed is covered, the water furrows should be cleaned out, and again late in autumn and early in the following spring. In Northern Europe it has been found a preventive against winter killing on strong clays, to sow the wheat in the bottom of each furrow, six inches deep, and cover it with the succeeding one. The wheat thus planted, comes up as soon as on the fields sown broadcast and harrowed, grows more vigorously, withstands the winters and produces large crops. Lightly plowing in wheat is, perhaps, under any circumstances, better than harrowing, as the wheat is thereby all buried, and at a more suitable depth than can be done by the harrow. The best drills now in use cover the seeds sufficiently for protection. The roughness of the furrows, when left without harrowing, is advantageous in heavy or clay lands, and only injurious in light or sandy.

After Culture.—Harrowing in the spring by loosening the soil, adds to the growth of the crop, and the loss of the few plants is much more than compensated by the rapid tillering and vigor of those which remain. Sowing in drills and hoeing between them is much practiced in Europe. The additional amount thus frequently raised would seem to justify the adoption of this mode of cultivation in this country; and it should at least be done so far as to give it a fair trial. On light soils, rolling the wheat both in fall and spring is highly advantageous. When the growth is luxuriant, decided benefit has attended feeding off the wheat on the field in the fall or spring, taking care to permit the animals to go on only when the ground is firm. This, however, should be cautiously done, and then only by light animals, as calves, or sheep.

Enemies of Wheat.—These are numerous. It is subject to the attack of the Hessian fly if sown too early in the fall, and again the ensuing spring, there being two annual swarms of the

fly, early in May and September. When thus invaded, harrowing or rolling, by which the maggots or flies are displaced or driven off is the only remedy of much avail. Occasionally other flies, and sometimes the wheat worm, or "midge," commit great depredations. There is no effectual remedy known against any of these marauders, beyond rolling, brushing, and harrowing. Dusting the grain with lime, ashes, and soot, have been frequently tried, as have also the sprinkling them with urine, diluted acids, etc.; and also by fumigating them in the evening when the smoke creeps along through the standing grain. For this last purpose a smoldering heap of damp brush, weeds, or chips, is placed on the windward side of the field, and its efficacy may be increased by the addition of brimstone. Whenever obnoxious to these attacks, the only safety is to place the crop in the best condition to withstand them, by hastening its growth, and by the propagation of the most hardy varieties. An application of unleached ashes in damp weather will sometimes diminish the ravages of worms at the root. Quicklime has the same effect on all insects with which it comes in contact, but it should be carefully applied to avoid injury to the plants.

These insect enemies come and go, in occasional, as well as in consecutive years, remaining shorter, or longer, as circumstances may happen. They are, no doubt, migratory over the land. In some parts of the country the Hessian fly, by its permanence of occupation, has actually driven wheat-growing out, altogether, when it would depart for a long term of years, and the grain again be grown. So, also, with that pestilent little wretch, the "midge," which, of late years, now we trust happily passed by, has been so destructive to the winter wheat of our Northern States. During these years—some six or eight in succession—the farmers were driven to the growth of spring wheat, which is never, or but seldom attacked by the midge. About the year 1862, the midge waned in its ravages in Western New York, and has since nearly, or quite left us. In that year we had upwards of one hundred acres of wheat on the ground, the most of it of spring

varieties. It had a good growth, and promised well; but when headed out, and in bloom, a little brown insect, about half the size and nearly the color of the common apple-tree, or bark louse, appeared upon the heads, effectually covering them so that the fields fairly looked brown—hundreds of them, almost, on a single head—but no signs of *midge.* We all supposed the crop was doomed; but on examination, the louse only worked on the *outside* husk of the kernel, and when harvest time came, it gradually disappeared. It scared us terribly, but did but little, if any actual harm. We had a good crop of sound, perfect grain. We never saw the insect on our grain before, nor have we seen it since. Yet the creature infested the country for a wide distance around us the same year. If any skeptic ever doubted the lice of Egypt, and the Omnipotent power which so developed and multiplied them in the days of the Israelitish bondage, a witness of the sudden production of these myriads upon our grain fields, would cure his infidelity at once.

Smut is a dark brown or blackish parasitic fungus, which grows upon the head and destroys the grain. The only remedy for this, is washing in two or three successive strong brines, and intimately mixing and coating the seed with quicklime.

Rust affects the straw of wheat while the grain is forming, and before it is fully matured. It is almost always present in the field, but is not extensively injurious, except in muggy (close, showery and hot) weather. The straw then bursts from the exuberance of the sap, which is seen to exude, and a crust of iron-colored rust is formed in longitudinal ridges on the stalk. It is generally conceded that this rust is a fungus or minute parasitic plant, which subsists on the sap; but whether it be the cause or consequence of this exudation is not fully determined. There is no remedy for this when it appears, and the only mitigation of its effects, is to cut and harvest the grain at once. The straw in this case will be saved, and frequently a tolerable crop of grain which partially matures after cutting; while if suffered to stand, both straw and grain will be almost totally lost. The only prevent-

ives experience has hitherto found, are the selection of hardy varieties of grain which partially resist the effects of rust; sowing on elevated lands where the air has a free circulation; the abundant use of saline manures, salt, lime, gypsum, and charcoal; the absence of recent animal manures; and early sowing which matures the plant before the disease commences its attack.

HARVESTING.—The grain should be cut immediately after the lower part of the stalk becomes yellow, while the grain is yet in the dough state, and is easily compressible between the thumb and finger. Repeated experiments have demonstrated that wheat cut then, will yield more in measure, of heavier weight, and a larger quantity of sweet, white flour. If early cut, a longer time is required for curing before threshing or storing.

Except in small fields, the cereal grain harvests are now usually cut by the horse reapers, unless when its *lodging*, from overgrowth or storms, which is not often the case, requires the use of the cradle or scythe. As good reapers are so widely distributed, we only suggest to the farmer to be sure and obtain a good article, and when secured, make proper use, and take good care of it, always housing it when not at work.

THRESHING is usually done among extensive farmers, with some one of the large horse machines taken into the field. The use of machines enables the farmer to raise some of the choicest kinds of grain, whose propagation was limited before their introduction, by the great difficulty of separating the grain from the head. He can also push his wheat into the market at once if the price is high, which is frequently the case immediately after harvest; and they save all expense and trouble of moving, storing, loss from shelling, and vermin, interest, insurance, etc. For the moderate farmer, a small, single or double horse machine, or hand threshing in winter, where there is leisure for it, is more economical than the six or eight horse thresher.

The use of the threshing machine, when not properly manned and attended to, is followed with great loss of grain and enormous waste of straw, particularly in employing itinerant threshers, who

go about the country to do the work. The machine should be a good one, perfect in all its parts, do its work well, and not liable to get out of order. Plenty of room should be given to feed it, to measure and bag, or carry away the grain, and dispose of the straw, which should be well and securely stacked at the time. No farmer can afford to throw away his straw, or leave it to be trodden down by cattle running over it in the field, or blown about and wasted by storms. In the winter season, if bright and clean, it is valuable as coarse fodder for young, or store stock, and as bedding for any stock in stables, or sheds, where it may be conveniently worked into manure. No matter how rich the land, manure on some part of it will be wanted. Steam threshers are now considerably used in England, and have lately been tried in America. The sooner they become thoroughly introduced, the less waste and trouble in securing our grain will be found.

Mowing or Stacking.—When stored in the straw, the grain should be so placed as to prevent heating or molding. This can only be avoided, unless very dry before carrying into the barn, by laying it on scaffolds where there is a free circulation of air around and partially through it. If placed in a stack, it should be well elevated from the ground; and if the stacks are large, a chimney of lattice or open work should be left from the bottom, running through the center to the top; or a large bundle may be kept at the surface in the center, and drawn upwards as the stack rises, thus leaving an opening from the bottom to the roof. Additional security would be afforded by similar openings horizontally, at suitable intervals, so as to admit the air from one side to the other. Mice and rats may be avoided by laying the foundation of the stack on posts or stones, elevated beyond their reach, and covered at the top with projecting caps. Weevils sometimes affect the grain after storing. These may be almost, if not wholly prevented, by thorough cleanliness of the premises where the grain is stored. It is much better, however, where barns are provided, or barracks made, to at once put it under shelter, and thresh it out at leisure when the hurry of the harvest is over.

The straw and chaff of wheat should never be wasted. This is the most nutritious of the cereal straws, and yields good fodder to cattle in time of scarcity, and is always valuable for this object when cut and mixed with meal or roots; and particularly when early harvested and well cured. Turnips and straw are the only food of half the cattle and most of the sheep throughout Great Britain, and nowhere do they thrive more, or better remunerate their owners, than in that country. It is of great use also as bedding for cattle, and as an absorbent of animal and liquid manures. It furnishes in itself the best manure for succeeding grain crops; containing large proportions of the salts or ash required. When threshed on the field, and not wanted for cattle, it should be scattered over the ground, and either plowed in or suffered to decay on the surface.

VARIETIES OF SEED.—Much depends on the proper selection of seed. Some soils are peculiarly adapted to wheat growing, and on these should be sown the finest varieties, which are generally of a more delicate character. Wheat, on other soils, is liable to many casualties, and on such, only the hardier kinds should be propagated. Careful and repeated experiments with different varieties of seeds, on each field, or on those which are similar, will alone determine their adaptation to the soil. There are several choice varieties of winter wheat in cultivation in the United States, some of which stand higher in one, and some in another section. Some in high repute abroad, have been introduced into this country and proved to be valuable acquisitions, while others have been found on trial, decidedly inferior to many of the long adopted varieties. Experiment alone will enable the farmer to decide as to their value for his own grounds, however high they may stand elsewhere. When of a fine quality, and found to produce well on any given soils, their place should not be usurped by others till repeated trials have shown their superiority, either in yield or quality. But when the acclimated grain is inferior, other seed from remote distances, even if no better in quality, may properly be substituted for it, as a decided benefit has been found to follow an exchange.

Wheat, and nearly all seeds, are found to be more productive when taken from a soil inferior to the one intended for sowing; and it is claimed that what is produced both in a warmer and colder climate will mature earlier. It is not essential that the fullest, heaviest grain be sown. Sprengel affirms that seed somewhat shrunken is more certain to give a good yield than the choicest seed; and numerous trials would seem to favor this conclusion. The grain designed for seed should be well ripened before harvesting. From the ever varying character of the different kinds of seed, their superiority at one time and on one locality, and their inferiority at other times and in other situations, it seems almost superfluous to give a particular enumeration of the present most popular kinds. A brief mention of such only as stand high in public favor in this country, with some of their most striking peculiarities, is all that our limits will admit.

The improved Flint is extensively cultivated in the fine wheat growing country of Western New York, where it was introduced in 1822. It is hardy, and withstands the winters remarkably well. A striking improvement in the strength of its straw has been observed, which at first inclined to lodge, but it is now erect and firm till fully ripened. The heads are also fuller and longer than when first introduced; the berry is plump and white, yielding a large proportion of choice flour; and it is retained in the head with great tenacity, which is a decided advantage for economy in harvesting, where threshing machines are substituted for the flail.

The old Genesee Red-chaff is a bald, white wheat, first cultivated in the same region in 1798, and for a long time it was the decided favorite. Since 1820, however, it has been very subject to rust and blast, but when circumstances are favorable it is still found to be highly productive. Its transfer to other localities, may therefore be attended with great success.

The White May of Virginia was a choice variety and extensively raised in the neighborhood of the Chesapeake bay in

1800, but is now nearly extinct there. It has been cultivated in New York many years, is a good bearer, and very heavy; weighing frequently sixty-six pounds per bushel, and ripens early, by which it escapes rust.

The Wheatland red is a new variety, discovered and propagated by General Harmon, of Monroe county, N. Y. It is held in high estimation, as it produces well and ripens early.

The Kentucky white bearded, Hutchinson or Canadian flint, is very popular in Western New York, where it has been rapidly disseminated since its first introduction some twelve years since. It is hardy, a good yielder, with a short, plump berry, weighing sixty-four pounds per bushel. It requires thicker sowing (about 25 per cent. more seed) than the improved flint, as it does not tiller as well, and unlike that, it shells easily, wasting much unless cut quite early.

The English Velvet-beard, or Crate Wheat, has a coarse straw, large heads, a good berry of a reddish hue, and is well adapted to the rich alluvial bottom lands, where its firm straw prevents its lodging. It is a fair yielder and tolerably hardy, but its long beard is a great objection to its introduction on such lands as are suited to the finer kinds.

The Yorkshire or English Flint, or Soules Wheat, has been some time introduced, and is similar in its leading features to the old Genesee.

The white Provence is a new and favorite variety, but its slender stalk frequently subjects it to lodging. It is only suited to the finest calcareous wheat soils.

The Blue-stem has been raised with great success in Union, Pa., where it resisted smut and rust when all other kinds in the vicinity were affected by it. It is grown in Western New York.

The Mediterranean is a coarse wheat with a thick skin, yielding a dark flour. It resists rust and the fly, is a good bearer, and may be profitably grown where other choice kinds fail.

The Egyptian, Smyrna, Reed, Many-spiked, or Wild Goose Wheat, is also a hardy variety, with a thick, heavy straw, which prevents its lodging.

New varieties, as the Diehl, midge-proof, amber, and other new sorts have since been introduced, and will almost every year be brought among us, all which may be tested and remain, or be discarded, as their merits may determine.

Production of new varieties of Wheat.—Besides introducing valuable kinds from abroad, and the improvement by careful cultivation of such as we now have, new varieties may be secured by hybridizing or crossing. This is done by impregnating the female organs of the flowers on one plant, by the pollen from the male organ of another. The progeny sometimes materially differs from both parents, and occasionally partakes of the leading qualities of each. Among those thus produced, some may be found of peculiar excellence and worthy of supplanting others whose value is declining. The effect of this crossing is striking in the ear of maize, where the red and white, the blue and yellow kernels are seen to blend in singular confusion over the whole ear, each differing, too, in size, shape, and general qualities. Observation will sometimes detect a new variety of wheat in the field, self hybridized, the result of an accidental cross. If this has superior merit, it should be carefully secured and planted in a bed by itself for future seed.

Propagation may be extended with incredible rapidity by dividing the plant. The English Philosophical Transactions give the result of a trial made by planting a single grain on the second of June; on the eighth of August it was taken up and separated into eighteen parts and each planted by itself. These were subdivided and planted between the fifteenth of September and the fifteenth of October, and again the following spring. From this careful attention in a fertile soil, five hundred plants were obtained, some containing one hundred stalks, bearing heads of a large size; and the total produce within the year was 386,840 grains from the single one planted.

Spring Wheat.—This requires a soil similar to that of winter grain, but it should be of a quick and kindly character, as it has a much shorter time to mature. The ground should be well

pulverized and fertile. The best crops are raised on land that has been plowed in the fall, and sown without additional plowing, taking care to harrow in thoroughly. When planted early the wheat rarely suffers from the fly, as it attains a size and vigor beyond the reach of injury before it appears. In certain localities where the fly abounds and the wheat has not been early sown, it is found necessary to keep back the young plants till the disappearance of the fly. Large crops have been obtained under favorable circumstances, when sown as late as the twentieth of May.

Varieties.—The *Black Sea Wheat* is one of the most popular kinds at present cultivated. Of this, there are two varieties, the red and the white chaff, both of which are bearded. The former is generally preferred. This wheat has yielded very profitable crops. The *Siberian* is a valuable wheat, and has been much raised in this country. It produces a full, fine grain, is hardy and a good bearer. The *Italian* has been much cultivated, and held in high estimation, but it is now generally giving place to the preceding where each has been tried. There are some varieties of *club* wheat successfully grown in the Western States and Canada, which may be sub-varieties of some of the kinds already mentioned.

There are still other varieties which bear well and are tolerably hardy. Excellent spring grain has been produced by early sowing from choice winter wheat, which has retained most of the characteristics of the original under its new summer culture. In large sections of this country, wheat has been seriously injured by winter killing and other casualties, and wherever these prevail and the soil is suited to it, summer wheat may be advantageously introduced. A proper attention to the selection of seed and the preparation of the soil, will generally insure a profitable return. If its market value is not as high, it may at least afford all that the farmer and his laborers require; and he will generally find, if not in a wheat growing region, that he can dispose of his surplus crop among his neighbors before the next harvest comes round, and at satisfactory prices.

RYE, (SECALE SEREALE,)

Is extensively cultivated in the North-eastern and Middle Atlantic States. It is grown on the light lands of Ohio, Michigan, and other Western States, and as the supporting elements of wheat become exhausted in the soil of the rich agricultural States of the West, it will take its place in a great measure on their lighter soils. Most of the Eastern and Atlantic States when first subjected to cultivation, produced wheat; but where lime did not exist in the soil the wheat crop soon failed, and it has gradually receded from the Atlantic border, except in marly or calcareous soils, or those that were reclaimed by a plentiful addition of lime, rye almost universally succeeding it. But the liberal use of lime, with the agricultural improvements of the present day, are regaining for wheat much of its ancient territory.

Rye resembles wheat in its bread-making properties, and for this purpose is only second to it in those countries where it is cultivated. There is a peculiar aroma attached to the husk of the grain, which is not found in the finely bolted flour. The grain when ground and unbolted is much used in the New England States for mixing into loaves with scalded Indian meal; it is then baked for a long time, and is known as *rye and Indian* or *brown bread.* This possesses a sweetness and flavor peculiar to itself, which is doubtless owing in no small degree to the quality above mentioned. Von Thaer says, "this substance appears to facilitate digestion, and has a singularly strengthening, refreshing and beneficial effect on the animal frame." Rye is more hardy than wheat, and is a substitute for it on those soils which will not grow the latter grain with certainty and profit.

Soil and Cultivation.—Neither strong clay or calcareous lands are well suited to it. A rich sandy loam is the natural soil for rye, though it grows freely on light sands and gravels which refuse to produce either wheat, barley or oats. Loamy soils that are too rich for wheat, and on which it almost invariably lodges, will frequently raise an excellent crop of rye, its stronger stem enabling it to sustain itself under its luxuriant growth.

The Preparation of the Soil for Rye is similar to that for wheat; and it may be advantageously sown upon a rich old turf or clover lay, or after corn or roots where the land has been well manured and thoroughly cleansed from weeds. There is not an equal necessity for using a brine-steep for rye as for wheat, yet if allowed to remain a few hours in a weak solution of saltpetre or some of the other salts, it promotes speedy germination and subsequent growth.

Sowing.—There is but one species of rye, but to this cultivation has given two varieties, the spring and winter. Like wheat, they are easily transformed into each other by sowing the winter continually later through successive generations to change it into spring grain, and the opposite for its re-conversion into winter grain. The last should be sown from the twentieth of August to the twentieth of September, the earliest requiring less seed, as it has a longer time to tiller and fill up the ground. Five pecks is the usual quantity sown, but it varies from one to two bushels, according to the quality of the soil, the richest lands demanding most. It is a practice among many farmers to sow rye among their standing corn on light lands, hoeing or cultivating it in and leaving the ground as level as possible. On such lands, this is attended with several advantages, as it gives the grain an early start, and a moist, sheltered position, at a time when drought and a hot sun would check or prevent vegetation. As soon as the corn is sufficiently matured, it should be cut up by the roots and placed in compact shocks, or removed to one side of the field, when the rye should be thoroughly rolled. When sown on a fresh plowed field, it should be harrowed in before rolling.

Great success has attended the turning in of green crops and following the fresh plowing with instant sowing of the seed. This brings it forward at once. No after cultivation is needed except harrowing in spring and again rolling if the land is light, both of which are beneficial, for, though some of the stools may be thus destroyed, the working of the ground assists the remaining plants so as to leave a great advantage in favor of the practice.

A friend of the writer had occasion to plow some land in the spring, which joined a field of rye belonging to a neighbor. The owner claimed damages for supposed injury by the team and plow, which it was agreed should be assessed on examination after harvesting, when it appeared that the damaged part was the best of the whole field. An honest English yeoman received several pounds from a liberal squire, for alleged injury to his young grain from the trampling of horses and hounds in hot chase after a fox; but at harvest he found the crop so much benefited by the operation that he voluntarily returned the money. If the rye is luxuriant, it may be fed both in the fall and spring. Early cutting, as in wheat, produces more weight, larger measure, and whiter flour. What is intended for seed must, however, be allowed to ripen fully on the ground.

Diseases.—Rye is subject to fewer casualties than wheat. *Ergot, or cockspur*, frequently affects it. This fungus is discovered not only on rye, but on other plants of the order graminæ. Several of these elongated, curved and brownish spurs appear on a single head, and they are most frequent in hot, wet seasons. They are poisonous both to man and beast, and when eaten freely they have generated fatal epidemics in the community; and emaciation, debility and, in some cases, death to animals consuming it.* The sloughing of the hoofs and horns of cattle has been attributed to ergot in their grass and grain. *Rust*, like that which affects the wheat crop, and owing probably to the same causes, attacks rye. When this happens it should be cut and harvested without delay.

Rye for Soiling is sometimes sown by those who wish late forage in autumn and early in spring. For this purpose it should be sown at the rate of two to four bushels per acre. If on a fertile soil and not too closely pastured, it will bear a good crop

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*** This may be doubted, although generally believed. We once knew a miller who tended a country grist mill—a big, stout fellow—who didn't believe much in the story, and, as a test of his want of faith, in its poisonous qualities, we saw him take up mouthfuls of the *ergot* or *cockspur* grain, and eat and swallow it, without any effect on him whatever.**

of grain; and, in some cases when too rank, early feeding will strengthen the stalk and increase the grain.

BARLEY, (HORDEUM,)

Is a grain of extensive cultivation and great value. Like wheat and rye, it is both a winter and spring grain, though in this country it is almost universally sown in the spring. There are six varieties, differing in no essential points and all originating from the same source. Loudon says, in choosing for seed, "the best is that which is free from blackness at the tail, and is of a pale lively yellow, intermixed with a bright whitish cast; and if the rind be a little shrivelled so much the better, as it indicates thin skin. The husk of thick-rinded barley is too stiff to shrink, and will lie smooth and hollow even when the flour is shrunk within. The necessity of a change of seed, from time to time, for that grown in a different soil, is in no instance more evident than in this grain, which otherwise becomes coarser every successive year. But in this, as in all other grain, the utmost care should be taken that the seed is full bodied." Counter to this, we never raised a better crop of barley than from seed so shrunken by drought that we could not sell it to the maltsters for any price.

The principal varieties are the two and six rowed; the last being preferred for hardiness and productiveness in Europe, and the first generally cultivated in this country for the superior fullness, and freedom from smut. There are numerous sub-varieties, such as the Hudson Bay, which ripens very early and bears abundantly; the Chevalier, and Providence, both accidental, of which a single stalk was first discovered among others of the ordinary kinds, and proving superior and of luxuriant growth, they were widely propagated; the Peruvian, Egyptian, etc. New varieties may be produced by crossing, as with wheat.

Soil.—Barley requires a lighter soil than will grow good wheat, and a heavier than will grow tolerable rye; but in all cases it must be one that is well drained. A mellow, rich loam, ranging

between light sand or gravel, and heavy clay, is best suited to it. It should be sowed early.

CULTIVATION.—It may be sown as soon as the ground is sufficiently dry in spring, on a grass or clover lay, turned over the preceding fall; or it may follow a well manured and cleanly hoed crop. If sown on a sod it should be lightly plowed in, but not so deep as to disturb it, and afterwards harrowed or rolled. The soil should always be well pulverized. From two to three bushels per acre is the usual allowance of seed, poor and mellow soils, and early sown, requiring the least. Barley should never follow the other white grains, nor should they succeed each other, unless upon very rich soil. No farmer can long depart from this rule without serious detriment to his soil and crops. Barn-yard manures should not be applied directly to this grain, unless it be a light dressing of compost on indifferent soils; or in moderate quantity after the plants have commenced growing in the spring. When the plants are four or five inches high, rolling will be of service, if the ground is dry and not compact. This operation gives support to the roots, destroys insects, multiplies seed stalks and increases their vigor.

Destroying weeds in grain.—When grain is infested with cockle, wild mustard or other weeds, they should be extirpated by hand before they are fairly in blossom. If neglected till sometime after this, the seed is so well matured as to ripen after pulling, and if then thrown upon the ground they will defeat the effort for their removal. When too luxuriant, barley, like rye, may be fed off for a few days, but not too closely. This, however, is seldom necessary.

THE HARVESTING of barley should be seasonably done, or its extreme liability to shell will cause much waste, and on the contrary, it will shrivel if cut before fully matured. It may be stacked like wheat. Early cut, it is much brighter than when left to full ripeness, when it has a dull, brownish color. We have seen the maltster make ten to twenty cents difference in the price of the same description of grain, solely from the time of cutting.

The uses of Barley are various and important. In Europe it forms no inconsiderable part of the food of the inhabitants. The grain yields from eighty to eighty-six per cent. of flour, which however contains but six per cent. of gluten; seven per cent. being saccharine matter, and seventy-nine mucilage or starch. It is inferior in nutriment to wheat and rye, but superior to oats. In this country it is principally used for malting and brewing, and in some cases for distilling, but when ground is more generally appropriated to fattening swine, though sometimes used for other stock.

THE OAT, (AVENA SATIVA,)

Is cultivated throughout a wide range of latitude, and on a greater variety of soil than any other grain. It will grow on rich or poor, and on dry, or moist soils; on the heaviest clays and the lightest sands; and it will pay as well on rich lands as any other crop. The average yield on good soils is from thirty to forty bushels per acre, and on the richest, when well cultivated, it has exceeded seventy bushels. It is exposed to fewer injuries than other grain, being seldom affected by rust, smut or insects. The wire-worm is most destructive to it, especially when sown on fresh sod. The most effectual mode of extirpating these and other troublesome insects, is to turn the sod over, late in the fall, just before our severe winter frosts. They thus become chilled, and incapable of seeking a safe retreat from their fatal effects. If not plowed at that time, it should be done immediately before sowing in spring, when by turning them into the bottom of the furrow, they cannot find their way to the surface, in sufficient numbers, to prey upon the plant before it gets beyond the reach of their attacks.

Varieties.—Of these, Loudon mentions nine as being well defined and entirely distinct, besides which there are many local or recent sub-varieties. He says: "*The White or common oat*, is in most general cultivation in England and Scotland, and is known by its white husk and kernel. *The Black oat*, known by

its black husk, and cultivated on poor soils in the North of England and Scotland. *The Red oat*, known by its brownish red husk, thinner and more flexible stem, and firmly attached grains. It is early, suffers little from winds, meals well, and suits windy situations and a late climate. *The Poland oat*, known by its thick white husk, awnless chaff, solitary grains, short white kernel, and short stiff straw. It requires a dry, warm soil, but is very prolific. *The Black Poland oat* is one of the best varieties; it sometimes weighs fifty pounds to the bushel. *The Friezland or Dutch oat*, has plump, thin skinned, white grains, mostly double, and the large ones sometimes awned. It has longer straw than the Poland, but in other respects resembles it. *The Potato oat* has large, plump, rather thick skinned, white grains, double and treble, with longer straw than either of the two last. It is now almost the only kind raised in the North of England and the South of Scotland, and brings a higher price in the London market than any other variety. They have all been derived from the produce of a single stalk which was first discovered growing in a field of potatoes in England, in 1788. *The Georgian oat*, is a large grained, remarkably profitable variety, and on rich soil, in good tilth, has produced more than any other variety. *The Siberian, Tartarian, or Horse-mane*, is by some conceded a distinct species. The grains are black or brown, thin and small, and turned mostly to one side of the panicle, and the straw is coarse and reedy. It is little cultivated in England, but is found very suitable for poor soils and exposed situations. *The Winter oat* is sown at the rate of two bushels per acre in October, the plants are luxuriant and tiller well, and afford good winter and spring pasture for ewes and lambs, and when these are shut out, it affords an ample crop of grain in August."

The Hopetown oat originated from a single stalk that was first discovered in 1824, by Mr. Sherriff, in a field of potato oats. It is distinguished by its exceeding height, aud superior produce when sown on rich soils. *The Dyock oat* is a recent sub-variety of the potato oat, and it is claimed for it that it exceeds the last

in the number of bushels yielded per acre, and also in the weight of the grain and the quantity of meal. *The Skinless oats*, much commended in Ireland, have been tried in this country without much success. They have shown a tendency to degenerate, the necessary effect of previous highly artificial cultivation. There are many other varieties which have a partial or local popularity, and from the readiness with which new kinds are produced, careful attention and observation on the part of the farmer, will detect from time to time such as may have a decided value over others for particular localities. A superior kind was discovered in a field of common oats in Oneida county, N. Y., some years since, and from the produce of one stool it became widely disseminated and has uniformly proved both hardy and prolific. The variety most cultivated in the United States, is the common white, which is hardy and a good bearer, weighing from thirty-two to thirty-five pounds per bushel. The black oat is preferred in Western New York and some other sections of the country. Repeated trials have been made with the potato oat, a heavy grain, weighing from thirty-five to forty-five pounds per bushel, but its merits have not proved conspicuous enough to have given it the place of the old and long tried varieties in the United States.

Various of the heavy oats, precedingly described, have been tried in this country, but our dryer, hot summers, do not agree with them. They gradually *run out* into our common lighter oats, and constantly require fresh imported seed to produce them.

Cultivation.—In this country oats are sown at the rate of two to four bushels per acre during all the spring months, and sometimes, though rarely, in June. The earliest sown are usually the heaviest and most productive. They may occupy a turf, or follow any of the well manured, hoed crops, as mentioned in the preceding grain. No apparent advantage has been derived from steeps for the prevention of smut, as in wheat: the impervious husk of the oat apparently arresting the liquid and preventing its penetration to the kernel. Sowing salt broadcast over the land at the rate of two to six bushels per acre, has been found

of use to the crop, both in furnishing it with a necessary manure and by killing insects. The seed should be well harrowed in and rolled, and no after attention is required except to destroy the prominent weeds.

Harvesting.—Oats frequently ripen unevenly, and if there is a large proportion of such as are backward, the proper time for cutting will be as soon as the grain in the latest may be rubbed out of the straw by hand. The oat is sufficiently matured for harvesting after it has passed the milk state, and is easily compressed between the thumb and finger. The lower part of the stalk will then have assumed a yellow color, and it ceases to draw nutriment from the soil. If cut at this time, the straw is better for fodder and for other uses; the grain is fuller; the husk lighter; and the loss from shelling, which is frequently a great item when left too late, is avoided. Oats, when very tall, used to be cut with the sickle, and when lodged, with the scythe; but when erect and of medium height, with the cradle, which, until the introduction of the reaper with us, was by far the most speedy and economical, and this leaves them in a suitable position for binding into sheaves. They may be stacked like wheat, but are far better housed in the barn.

The uses of oats are various, and differ materially in different countries. In Scotland, Ireland, and many other countries, oat meal is much used as human food, and for this the potato oat, or some one of the heavy kinds is preferred, as they afford a larger proportion of meal and less of husk. Scotland, "the land o' cakes," draws no inconsiderable part of the consumption of her laboring population from this meal, which is formed into small, thin cakes, and eaten with milk, butter, etc., or it is mixed with water or milk, and made into puddings, and other wholesome preparations, quite palatable to those accustomed to it.

A celebrated German chemist, A. Müller, gives the following analysis: starch 55.4; gum and sugar, 2.5; gluten, etc., 8.8; fat, 6.4; bran, 9.6; water, 14.6; ash 2.7; and 33 of

husk in 100 parts. They are but little used for human food in this country, and this is principally by emigrants who bring their early habits with them. They are prepared by kiln-drying and hulling, then grinding and bolting, when required to separate the flour. The meal is scalded before using, and mixed with about half its weight of wheat flour when made into bread. It is sold by the apothecaries to invalids, for whom it is valuable on account of its light, digestible character. It is also stirred into water, making an excellent beverage for laborers in hot weather. The principal use of oats, however, in the United States, is as food for working animals, for which it is unrivaled. Oats are sometimes used when ground, for fattening cattle, sheep and swine, but for this purpose they are far surpassed by corn, barley, peas, or boiled potatoes. They are an excellent fodder for stock sheep, and for them are most economically fed in the straw, if cut early.

INDIAN CORN, (ZEA MAIZE.)

This, next to the grasses, is by far the most important crop of the United States. The effect of the immense production of a staple article is felt in every department of our agriculture, and is conclusively shown by the great value of our beef, pork, mutton, human food, whisky and highwines, to all of which corn is made largely to contribute. Nearly all the beef and pork of the vast and fertile West, and much in the North and South is fed upon it. Corn seems to have been created for this Western hemisphere. It is raised in boundless luxuriance from the frozen regions of Canada, almost to the Straits of Magellan. It riots in the fierce blaze of our cloudless Western sun, and it is here that it attains the highest perfection. Its most prolific area on this continent lies between 40° north and 38° south latitude, deducting a limited portion of the equatorial regions. Close attention in its cultivation is necessary when receding from these limits towards the poles, on account of a deficiency of sun for ripening it. In such localities, the smaller and earlier kinds should be planted on a warm soil, so as to mature before the first frosts.

Varieties.—There is no one of the cereal grains or grasses which manifests itself under such multiplied forms as maize. From the little shrubby stalk that grows on the shores of Lake Superior, to the palmetto-like corn of the Ohio and Mississippi valleys, and from the tiny ears and flattened, closely clinging grains of the extreme North, the brilliant rounded little pearl, or the thickly wedged rice corn, to the magnificently elongated, swelling ear of the Kentucky, with its deep indented gourd seed, it is developed in every grade of sub-variety. The kernels are long, round, or flat, and are white, yellow, blue, red or striated; but each contain the same principles of nutriment combined in somewhat different proportions, and contributes for equal weights, nearly in the same ratio, to the support of man and the lower order of the animal creation. The analysis of corn, as given by Palson, is in 100 parts, of

Gluten, etc.,	8.8
Starch,	54.4
Gum and sugar,	2.7
Oil,	4.6
Bran, etc.,	15.8
Ash,	1.7
Water,	12.
	100

Besides the kinds in general cultivation in this country, varieties have been occasionally introduced from abroad, of a character so different as almost to entitle them to the distinction of independent species. Such are the Chinese tree corn, bearing its slender ears at the extremity of several expanded branches; the Egyptian, with its millet-like head; the Oregon, with its separate husk or envelope for every distinct kernel. But if we narrowly watch the vagaries of nature, we shall notice deviations from the matter of fact standards of our domesticated varieties, which approximate so closely to the most fanciful of the exotics, that we are compelled to believe that all those which have hitherto come within our notice, originated from one common head; and that all the peculiarities are owing to the difference of soil, climate and culture, and the carefully cherished eccentricities of nature, aided by a skillful science, or well practiced art. It is needless

to particularize the many popular kinds of corn under successful cultivation in this country. They are found to vary with almost every degree of latitude and longitude; and there are not unfrequently, numerous kinds held in deservedly high estimation within a single district. From these there will be no difficulty in selecting such as will best repay the farmer's attention.

The Soil for corn must be dry, rich and well pulverized. Neither strong clay, wet, or poor lands will yield good crops of corn. Land can scarcely be too rich for it, and the fresher and less fermented the manure applied to it is, unless on light, sandy soils, the better it will be for the crop. A great error is committed in raising corn as with most of our tillage crops, from not having the soil sufficiently enriched; though this error is diminished in the case of such as will not bear an excess of manure. Corn is a gross feeder and necessarily ranges over a great space in search of food. It has a large amount of stalk, leaves and grain to provide for in a few weeks, and its increase will be commensurate with the supply of food.

The rapidity with which corn grows in the richest river bottoms, and prairie lands of the Ohio and Mississippi valleys, is surprising to those not familiar with its habits. After a heavy rain in the months of July or August, it frequently makes a growth of some inches in a single day. In passing through a field, one can actually "hear it grow," by the *cracking* of the sheaths at the foot of the leaves, by the swelling stalks, making a report like the tiney *feu de joie* of a thousand fire-crackers.

A clover lay, or rich grass sod is an excellent preparation for corn, with the addition of manure when required. But the manure should always be scattered broadcast, plowed and well harrowed in. The roots will be certain to find it, and in consequence of its general diffusion, the development of the ear and grain will correspond with that of the stalk and leaves. When manured in the hill, on poor soil, it comes forward early, and this induces an extension of the roots, which finding little support, the crop is limited to the stalks and leaves, and a smaller proportion of grain.

THE SELECTION OF SEED should be made with the utmost care, not only from the best varieties, but the best seed of the particular kind desired. Some of the choicest have been brought to their present perfection by selecting only the earliest and largest ears from the most prolific stalks. This ought always to be done before the corn is gathered in the field where there is an oppor tunity for comparison.

PREPARATION OF SEED.—Repeated experiments have demonstrated the great utility of steeping corn for twenty-four to forty-eight hours before planting, in a solution of saltpeter. This accelerates the growth of the plant, and is a protection against birds, squirrels and mice, and for a while it will keep off worms. An effectual remedy against these depredations is to add half a pint of boiling tar to a peck of seed, stirring the corn briskly for several minutes as the tar is added, till every kernel is thinly coated with it. This supercedes the necessity of the worse than absurd remedy of scarecrows. The majority of birds are of great advantage to the farmer on all his fields, as they pick up numberless insects, grubs and worms which infest the ground, and destroy or seriously injure the vegetation.

PLANTING.—Corn may be planted in hills from three to four and one-half feet asunder, and with from three to five stalks well spread in each hill, according to the kind of seed, quality of land, etc. Some plant in drills, but this is objectionable, as the trouble of cultivation is greater, without increasing the yield. Thick planting gives fewer ears upon a stalk, and those of less size. The time of planting at the North is usually within the three first weeks of May, depending much on the season. Late frosts will sometimes cut down the first leaves without destroying the germ, but it is always best to defer planting till all apprehensions of it are removed. In the more Southern States, earlier planting is desirable, and it is there put into the ground in March and April.* To give regularity to the rows and facilitate after culture, the

* It is said that the old Indian rule was, "When the oak leaves grew to the size of a squirrel's foot, it was time to plant corn."

furrows for the seed should be struck out each way with the utmost exactness, and twice the corn planted that is required to remain. It should be covered about two inches. The surplus plants can be pulled up at the second hoeing when all fear of injury is past. If the land is light, it should be laid flat before planting, and after this, it should be thoroughly rolled. Corn planting implements, by hand and horse power, have lately been introduced to great advantage over the old way of hand and hoe planting.

Cultivation.—The ground may be stirred when the plants first show themselves. This is most economically done with the cultivator or light plow, and if the operation be frequent and thorough there will be little use for the hoe. Hilling or heaping the earth around the plants should always be avoided, except with very heavy soil or such as is liable to an excess of moisture; in all other cases it should remain flat. Stirring the ground in dry weather is peculiarly beneficial to corn and all hoed crops. Some omit it then from fear of the escape of moisture, but its effect is precisely the reverse, as nothing so certainly produces lightness, porosity, and unevenness in the soil, which under the head of soils and draining, we have shown facilitated the admission and escape of heat, that inevitably secures the deposit of large quantities of moisture, even in the driest and most sultry weather. Corn and other crops, which were withering from excessive drought, have been at once rescued from its effects by a thorough use of the plow and cultivator. Well drained, dark colored and rich porous soils will be found to suffer much less in drought than others which lack these characteristics.

Harvesting.—If there be no danger of early frost, the corn may be suffered to stand until fully ripe; though if the stalks are designed for fodder, they are better to be cut when the grain is well glazed, and this should be done in all cases where frost is expected. Scarcely any injury occurs either to the leaf or grain if the corn be stooked, when both would be seriously damaged from the same exposure if standing. The stalks of corn should

never be cut above the ear, but always near the ground, and for this obvious reason: The sap which nourishes the grain is drawn from the earth, and passing through the stem, enters the leaf, where a change is effected analogous to what takes place in the blood when brought to the surface of the lungs in the animal system; with this peculiar difference, however, that while the blood gives out carbon and absorbs oxygen, plants under the influence of light and heat, give out oxygen and absorb carbon. This change prepares the sap for condensation and conversion into the grain. But the leaves which thus digest the food for the grain are above it, for it is while passing downward that the change of the sap into grain principally takes place. If the stalk be cut above the ear, nourishment is at an end. It may then become firm and dry, but it is not increased in quantity, while, if cut near the root, it not only appropriates the sap already in the plant, but it also absorbs additional matter from the atmosphere, which contributes to its weight and perfection. It must be perfectly dried in the field, and after this husked and carried into an airy loft or stored in latticed or open barracks. The stalks may be housed or carefully stacked for fodder. Many of our western farmers allow both grain and stalks to stand in the field till wanted for use, when they are fed in an adjoining enclosure. This is more economically done by first cutting (or what is better, by both cutting and *grinding*, which may be accomplished by recently invented machinery,) and then mixed either with roots or meal. When fodder is high, the stalks and leaves will repay the expense of cultivation.

Corn for Soiling.—Corn has recently been much cultivated for fodder, and for this purpose the soil should be in high condition and well pulverized. It should be prepared in a pickle of saltpeter, like that intended for ripening, and may be sown broadcast and harrowed in at the rate of three or four bushels per acre. A much better method is to sow thickly in drills and stir the ground with a light plow or cultivator. The sowing may be done early or late, though the first is most successful. It should

be cut before the frosts touch it, and dried previous to housing. Several tons of excellent forage have been raised from a single acre. In the report of Mr. Leak to the Pedee Agricultural Society, of South Carolina, it is asserted that 138,816 pounds of green cornstalks have been cut from one acre in a season, weighing when dry, 27,297 pounds.

THE USES OF CORN in this country are various. It is largely fed to fattening and working animals, but must be carefully fed to the latter and only in cool weather. It is extensively manufactured into highwines and whisky, (the latter a sad perversion of one of its best uses.) It is converted into oil, molasses and sugar to a very limited extent, and is variously and largely applied to domestic uses. While green it is boiled and roasted in the ear, or it is cut from the cob and cooked with the garden or kidney bean, which forms the Indian *succotash.* When ripe, it is hulled in a weak lye, then boiled and known as *hulled corn;* or parched over a hot fire, affording a delicious lunch and a convenient provision for hunters as *popped* corn. *Hominy, or samp,* is a favorite dish, and consists of corn coarsely ground and boiled in water; and *hasty pudding, or mush,* differs from this in being made of fine meal. The meal may be compounded with milk and eggs into *johnny cakes,* puddings, griddles and other delicacies universally esteemed for the table, while corn bread, in infinite ways of cooking, is a standing and favorite food with a large majority of all *native* Americans.

RICE, (ORYZA SATIVA,)

Contributes directly to the support of a larger number of the human family than any other plant. In China, and nearly the whole length of the southern part of Asia, through the innumerable and densely populated islands of the Pacific and Indian oceans, in the southern part of Europe, and a large extent of Africa, and through no inconsiderable portion of the North and South American continent, it is extensively grown, and forms the staple food of the inhabitants. Rice requires a moist soil, and is

much more productive when subject to inundation. A hot sun is also necessary to mature it, and as a result of these two essential conditions, its culture is limited to regions much more circumscribed than are allotted to wheat, maize or some of the usually cultivated plants. We subjoin from the "American Agriculturist," an excellent article on the cultivation of rice, from the pen of Dr. Cartwright:

"There are many varieties of rice, but I am induced to believe that they are all essentially aquatic. All the varieties yet discovered flourish best under the inundation system of culture; yield more to the acre, give less trouble, and require less labor. Nevertheless, each variety grows pretty well on light, moist uplands, without irrigation, when cultivated with the hoe or plow. The product, however, is so much less than by the irrigation system, and the labor of tillage so much more, that the upland producer never can compete successfully with the lowlander. The farmer may curtail his expenses by growing rice for domestic uses, but he cannot, very profitably, produce it for sale. Besides the tenfold labor which rice on upland requires, in comparison to that cultivated by the irrigation system, it cannot be sown thick enough to make a larger yield per acre. Space must be left for the plow or hoe to till the rice, which is not necessary in those localities where it can be overflowed at will and the water drawn off as occasion may require.

"The method pursued on the rice lands of the lower Mississippi is to sow the rice broadcast, about as thick as you sow wheat at the North, and harrow it in with a light harrow having many teeth, the ground being first well plowed and prepared by ditches and embankments for inundation at will. It is generally sown in March. Immediately after sowing the water is let on, so as barely to overflow the ground. The water is withdrawn on the second, third or fourth day, or as soon as the grain begins to swell. The rice very soon after comes up and grows finely. When it has attained about three inches in height, the water is again let on, the top leaves being left a little above the water. Complete

immersion would kill the plant. A fortnight previous to harvest the water is drawn off to give the stalks strength, and to dry the ground for the convenience of the reapers.

"A different method is practiced in the northern part of Italy. The seed is sown in April, previously to which it is soaked a day or two in water. After sowing, about two inches of water is let in upon the ground. The rice comes up through the water, which is then drawn off to give the plant strength, and after some days is again let on. The rice is more apt to mildew under this practice than our method of letting the water on, about the time the Italians draw it off.

"The same measure of ground yields three times as much rice as wheat. The only labor after sowing is to see that the rice is properly irrigated, except in some localities where aquatic plants prove troublesome, the water effectually destroying all others.

"The rice grounds of the lower Mississippi produce about seventy-five dollars worth of rice per acre. The variety called the Creole white rice is considered to be the best. In the eastern part of the State of Mississippi, called the '*piny woods*,' rice is very generally cultivated on the uplands. Although it cannot be made a profitable article of export, yet it affords the people of that interior region an abundant supply of a healthy and nutritious food for themselves and a good provender for their cattle, and makes them independent of the foreign market. Unlike other kinds of grain, it can be kept for many years without spoiling, in a warm climate, by simply winnowing it semi-annually, which prevents the weevil and a small black insect that sometimes attack it. It is cultivated entirely with the plow and harrow, and grows well on the pine barrens. A bull-tongued plow, a kind of shovel plow, drawn by one horse, is driven through the unbroken pine forest; not a tree being cut or belted, and no grubbing being necessary, as there is little or no undergrowth. The plow makes a shallow furrow about an inch or two deep, the furrows about three feet apart. The rice is dropped into them and covered with a harrow. The middles, or

spaces between the furrows, are not broken up until the rice attains several inches in height. One or two plowings suffice in the piny woods for its cultivation—weeds and grass, owing to the nature of the soil, not being troublesome. A similar method of cultivation obtains on the prairie land of the North-western States.

"Rice, like hemp, does not impoverish the soil. On the contrary, it is a good preparatory crop for some others, as Indian corn. The pine barrens of Mississippi would produce rice *ad infinitum*, if it were not that the land, after a few years, owing to the sandy nature of the soil, becomes too dry for it. It has been ascertained by Arnal that twelve pounds of wheat flour and two pounds of rice will make twenty-four pounds of an excellent bread, very white and good; whereas, without the addition of rice, fourteen pounds of flour will only make eighteen pounds of bread.

"Like other kinds of grain, rice adapts itself to the soil and climate, and particular mode of cultivation; but if the seed be not changed, or selected from the best specimens of the plant, it will ultimately degenerate. Thus in Piedmont, after a long series of years, the rice became so much affected with a kind of blight called the *brusone*, as to compel the Piedmontese to import fresh seed in 1829, from South Carolina. The American rice introduced into Piedmont escaped the *brusone*, but it was several years before it adapted itself to the soil and climate. Some years ago, a French traveler by the name of Poivre, finding rice growing in great perfection on the mountains and highlands of Asia, particularly Cochin China, named it "*riz sec*," or dry rice, and sent the seed to Europe, where many experiments were made with it. It yielded no better than any other kind of rice, and was found like all others, to succeed best when inundated. The reason why it yielded so much more in Asia than in Europe, can be readily accounted for, by the natural inundations it receives from the excessive rains during the monsoons.

"No variety has been discovered which yields as much out of the water as it does in it. There are many localities in the

United States, where the culture of rice by the irrigating system, would rather serve to make the surrounding neighborhoods healthy instead of sickly. It is generally admitted, that a given surface of ground completely inundated, is much less unhealthy than the same surface partially inundated, or *in transitu* between the wet and the dry state. Hence mill ponds, which partially dry up in the summer, are fruitful sources of disease. Some of the best rice is said to grow on the bottom of mill ponds. Nothing more is necessary, than to make the bottom of the mill pond perfectly level, and then to overflow the whole surface just deep enough to keep the top leaves above water. As if to show, that unhealthiness is not necessarily connected with the culture of this valuable grain, nature has imposed a law upon it, ordering that it should flourish better when overflowed with pure running water than with the stagnant waters of impure lakes and marshes.

"There are two kinds of rice which are said to succeed best on uplands: the long and the round. The former has a red chaff, and is very difficult to beat out from the husk. The latter shakes out, if not cut as soon as ripe. They nevertheless succeed best under the inundation system of culture. In the Eastern hemisphere, rice is cultivated as far north as the forty-sixth degree of latitude. The climate of the United States is better suited to it than that of Europe, because our summers are hotter. In the northern part of China, the variety called the Imperial rice; or *riz sec de la Chine*, (the *oriza sativa mutica*,) is more precocious than any other, is said to yield a heavy harvest, and to constitute the principal food for the people of that populous region. But it has succeeded no better in Europe than any other kind of rice.

"The best rice lands of South Carolina are valued at five hundred dollars per acre, while the best cotton lands sell for a tenth part of that sum, proving that rice is more profitable than cotton. The profits of a crop should not so much be estimated by the yield per acre, as the number of acres a laborer can till.

After the land is properly prepared for inundation, by leveling, ditching, and embankments, a single individual can grow almost an indefinite quantity of rice. Rice is no doubt ultimately destined to supercede cotton in a large portion of Mississippi and Louisiana." Under the now changed and free system of labor in the South, this fact may be somewhat problematical. But things will all find their level, and after a time, we trust, resume a substantial, well compensated, and happier disposition of labor than ever before.

MILLET, (PANICUM MILLIACEUM.)

In its growth and the manner of bearing its seeds, the millet strongly resembles a miniature broom corn. It grows to the height of two and a half to four feet, with a profusion of stalks and leaves which furnish excellent forage for cattle. From eighty to a hundred bushels of seed per acre have been raised, and with straw equivalent to one and a half or two tons of hay, but an average crop may be estimated at about one-third this quantity. Owing to the great waste during the ripening of the seed, from the shelling of the earliest of it before the last is matured, and the frequent depredations of birds which are very fond of it, millet is more profitably cut when the first seeds have begun to ripen, and harvested for fodder. It is cured like hay, and on good land yields from two and a half to four tons per acre. All cattle relish it, and experience has shown it to be fully equal to good hay.

Cultivation.—Millet requires a dry, rich, and well pulverized soil. It will grow on thin soil, but best repays on the most fertile. It should be sown broadcast or in drills, from the first of May to the first of July. If for hay, and sown broadcast, forty quarts per acre will be required; if sown in drills for the grain, eight quarts of seed will suffice. It will ripen in sixty to seventy-five days, with favorable weather. When designed for fodder, the nearer it can approach to ripening, without waste in harvesting, the more valuable will be the crop.

BUCKWHEAT OR BEECHWHEAT, (POLYGONUM FAGOPYRUM,)

Is a grain much cultivated in this country. It grows freely on light soils, but yields a remunerating crop only on those which are fertile. Fresh manure is injurious to this grain. Sandy loams are its favorite soils, especially such as have lain long in pasture, and these should be well plowed and harrowed. It may be sown from the first of May to the tenth of August, but in the Northern States this ought to be done as early as June or July, or it may be injured by early frosts, which are fatal to it. It is sown broadcast at the rate of two to four pecks per acre, and harvested when the earliest seed is fully ripe. The plant often continues flowering after this, and when the early seed is blighted, as is often the case, the plant may be left till these last have matured. As it is liable to heat, it should be placed in little *stooks*, of the size of a two bushel basket, over the field, and as soon as dry, taken in and threshed out. If not perfectly dry, the straw may be stacked with layers of other straw, and when well cured, it will be a valuable fodder for cattle. Sheep and young horses will feed and thrive as well on this straw as on ordinary hay.

USES.—This grain is ground and bolted, and the flour is much used for human consumption. Before grinding, the hull or outer covering is removed, and when thus prepared, the flour is as white and delicate in appearance as the best rye. It is equally light and digestible, and is scarcely inferior to wheat in its nutritive properties. The grain is used for fattening swine, but is most profitable when mixed with corn. Poultry thrive upon it. Buckwheat was formerly employed as a fertilizer, but for this object it is inferior to the clovers in all cases where the soil is capable of sustaining them. Its rapid growth will insure the maturing and turning under of two crops in one season. There are other varieties than the one specified, but none of equal value for general cultivation in this country.

CHAPTER VIII.

LEGUMINOUS PLANTS.

THE PEA, (PISUM SATIVUM.)

THE pea, bean, tare, vetch, lupine, the clovers, etc., are al. embraced in the botanical order *Leguminosæ*. The pea is valuable for cultivation not only for the table, but for many of the domestic animals. It is much fed to swine, sheep and poultry. For the former, it should be soaked, boiled or ground. If land is adapted to it, few crops can be more profitably raised for their use. They ripen early, and when beginning to harden they may be fed with the vines, and the animals will masticate the whole and soon fatten.

THE SOIL.—The heaviest clays will bear good peas, but a calcareous or wheat soil is better. Strong lands produce the best crops, but these should be made so by manures previously applied, as the addition of such as are fresh increases the growth of haulm or straw, and sometimes diminishes both the quantity and quality of the pea. When sown on a thin sward, the manure should be spread before plowing. A dressing of well rotted manure increases the crop, and is a good preparation when intended to be followed by wheat.

VARIETIES.—Of these there are many. The earlier kinds are generally indifferent bearers, and their cultivation is limited almost exclusively to the garden. Of those for field culture, the marrowfat are preferred for good lands, and are a rich pea. The small yellow are perhaps the best for poorer soils. There is a very prolific *bush pea* grown in Georgia, bearing pods six or seven

inches long, which hang in clusters on a short, upright stem. The pods are filled with a white pea, which is highly esteemed for the table either green or dry. In that latitude they bear two or three crops in one season.

Cultivation.—Peas should have a clean fallow, or fresh, rich sod, well harrowed. They are not affected by frosts, and may be sown as soon as the ground is dry. This will enable them to ripen in season to plow for wheat. They are very liable to attack from the pea bug, which deposits its egg in the pea while in its green state, where it hatches, and the worm by feeding on the pea, diminishes its weight nearly one-half. Here it remains through the winter and comes out as a bug the following season. To avoid this pest, some sow only such seed as has been kept over two years, while others sow as late as the fifteenth or twenty-fifth of May, which delays the pea till after the period of its attacks, but this latter practice seldom gives a large crop. It may be killed by pouring boiling water upon the seed, stirring for a few minutes, and then draining it off. Peas are sometimes sown in drills, but most usually broadcast, at the rate of two or three bushels per acre. It is better to plow them in to the depth of three inches and afterwards to roll the ground smooth to facilitate gathering. When sown in drills they may be worked by the cultivator soon after coming up. The growth is promoted by steeping the seed for twenty or thirty hours in urine, and then rolling it in ashes or plaster.

Harvesting is accomplished by cutting with the scythe, or what is more expeditious, (when fully ripe, so that the roots pull out easily,) with the horse rake. When thus gathered into heaps and well dried, they may be threshed out and the haulm carefully stacked and saved for sheep fodder. If this is secured in good condition, cattle and sheep will do well upon it. Peas are frequently sown with oats, and when thus grown they are fed to sheep unground, or made into meal for swine.

The Cow Pea.—This is grown in the Southern States, and is valuable either as a fertilizer or as food for domestic animals.

Its long vines and succulent leaves, which draw much of their substance from the air, and its rapid and luxuriant growth, particularly adapt it to the first object, while its numerous and well filled pods, and its great redundancy of stem and leaf, afford large stores of forage. This is improved for cattle when harvested before the seed is fully ripe. It is sown broadcast, in drills, or hoed in among corn, when the latter is well advanced. If in drills, it may be cultivated in its early stages by the plow, shovel-harrow or cultivator. It may be cut with the scythe or drawn together with a heavy iron-toothed harrow, or horse rake, as with the common pea. It requires a dry, medium soil, and is well suited to clays.

THE BEAN, (PHASEOLUS VULGARIS.)

The bean is often a field crop in this country, and especially in the Northern and Middle States. It is principally used either green or dry for the table. It is a palatable and highly condensed food, containing much in a small compass. In proportion to its weight, it gives more nutriment than any of the ordinary vegetables; according to Einhof, yielding 84 per cent. of nutritive matter, while wheat gives only 74. It has, in common with the pea, vetch, etc., though in a greater proportion, a peculiar principle termed *legumin*, which is analagous to *casein*, the animal principle in milk, which is convertible into cheese, and in its nutritive properties it is essentially the same as the *fibrin* of lean meat, the *albumen* of eggs, and other animal matter. There is no vegetable we produce so fitted to supply the place of animal food as the bean.

SOIL.—The bean is partial to a quick, dry soil, too great strength or fresh manuring giving a large quantity of vine without a corresponding quantity of fruit.

CULTIVATION.—The land should be finely pulverized, and if at all inclined to wet it should be ridged. Beans are tender plants and will not bear the slightest frost, and, as they grow rapidly, they will be sure to ripen if planted when this is no longer to be

apprehended. The seed is exposed to rot if put into the ground in a cold, wet time, and the land should, therefore, be previously well warmed by the sun. The bush beans are the only kind used for field planting, and of these there are several sub-varieties. The long garden pole beans, white, red or mottled, are great bearers, of fine quality and early maturing, but the Lima bean, although later, is the richest and best of all for table use. Early ripening, with field beans, is important, when other crops are to succeed the same season. They are usually planted in hills about two feet apart, and also in drills covered two inches with fine earth. They have been sown broadcast, on clean dry soils, and produced largely. When planted in hills, from four to six plants should be left in each, according to their proximity, or if in drills they need about one and a half bushels of seed to the acre.

HARVESTING.—When the beans are fully formed and there is any danger of frost, they should be at once secured, but this scarcely affects them when they are gathered and thrown into heaps. If the ground is not wanted for other uses, they may stand until the latest pods assume a yellow color. They are pulled with ease when the plant is mature, as the fibres of the roots are by that time dead. This is more quickly accomplished with an iron hook rake, or if the stalks are partially green they can be mown. The vines, if not dry, should remain for a while in small heaps, and afterwards collected in larger piles around stakes set at convenient distances, with the roots in the center and secured at the top by a wisp of straw; and when well dried they should be threshed, cleaned and spread till quite free from dampness. The straw or haulm is an excellent fodder for sheep and should be stacked for their use. Beans are one of the best kinds of winter food for sheep when fed in small quantities. Forty bushels have been raised on an acre, and worth from $1 to $3 per bushel. Twenty to thirty bushels per acre is the usual crop. Sheep are the only animals which will eat them raw, but swine, cattle and poultry will thrive on them boiled.

There are three varieties of field, or bush bean usually cultivated in the United States. The *small white* is most commonly grown. It is the most prolific, bearing the closest culture, and the best for shipping purposes, being very hard, solid, and keeps longest on sea voyages. The *kidney*, or long white, is much larger and of better edible quality, requiring a longer time to mature, with a ranker growth; and the *marrow*, with a large round kernel, and of equally good edible quality as the kidney, requiring the same time to mature. These two last are usually worth full 25 per cent. more in the market than the small white, on account of their superior excellence for table use.

THE ENGLISH FIELD BEAN, (VICIA FABA,)

Is cultivated under many varieties in Europe, and particularly in Great Britain, as a field crop for the use of horses and other animals. Among these are *the Windsor*, *the thick*, *the long pods*, *and others*. Arthur Young prefers "the common little horse bean as being more generally marketable." We have tried several of these varieties, and, although entirely successful, have found them less adapted to our climate and agriculture than the ordinary crops. They prefer strong clay or loam clay soils. They cannot be profitably grown in America, the climate being too hot and dry for them.

THE TARE, VETCH OR FITCH, (VICIA SATIRA,)

Is an important field crop in Europe for its stem and leaves as animal food. It is hardy and productive, and considered valuable for green fodder or soiling. There are two kinds, the winter and spring. It is partial to a clay, but grows indifferently on any rich soil which is not too dry. It is sown broadcast or in drills, but generally the former, on well pulverized lands, and covered with the harrow, demanding no after attention but the extermination of weeds. They are most useful for soiling, but may be fed on the ground or cut for hay. Tares have, hitherto, been little grown in this country, but in certain soils and situa-

tions they may be introduced as a substitute for clover, where, from any cause, the latter does not grow successfully. All domestic stock are fond of them. As yet, tares have had little success here, owing, probably, to our dry and hot summers.

THE PINDA OR GROUND PEANUT, (ARACHIS HYPOGÆA.)

This is a legumen, and is cultivated with profit in the Southern States, on light sandy lands, where it yields from twenty to even fifty bushels per acre, besides furnishing much haulm for forage. It is sown in drills four or five feet apart, and worked with a light plow or cultivator immedietely after the plants show themselves above ground. They soon overspread the whole surface, like a bushy running pea. It has a yellowish pea-like blossom. The small pod, contained in the blossom, strikes downward into the soil, and ripens its seed beneath the surface.

When properly matured, the pods are loosened by a fork and pulled up by hand, and after curing are put under cover for winter's use. They contain a large quantity of oil, but in other respects, closely resemble the common pea and bean in their nutritive qualities. They are in high repute for their fattening qualities.

CHAPTER IX

ROOTS AND ESCULENT TUBERS.

THE POTATO, (SOLANUM TUBEROSUM.)

The potato is a native of the American Continent. It is found in a wild state both in Buenos Ayres and Chili, and was probably discovered in the same condition by the early settlers of North America. It was supposed to have been taken into Spain and Italy early in the sixteenth century, by Spanish adventurers, as it was cultivated in those countries in 1550.. In 1588 it was introduced into Vienna from Italy, and also into England probably as early as 1586, by the colonists of Virginia who were sent out by Sir Walter Raleigh. It was regarded in Europe at first as a delicacy; but not until within a comparatively recent period has it found its way in both continents, as an article of agricultural attention, and an almost indispensable food for man and beast. As an illustration of the neglect of the potato in this country as a field crop, the writer may mention that he once knew an extensive eastern farmer, who, late in the last century had raised in one year seven bushels of potatoes. After disposing of all that was wanted for his own and his neighbors' consumption, he had still a surplus left. A farmer on the same premises at the present day, would deem seven hundred bushels a short crop.

Varieties.—These are almost illimitable. They differ in form from round to oblong, are flat and curved, or kidney-shaped; they vary in size from the delicate lady-finger to the gigantic blue-nose; their exterior is rough or polished, and of almost every hue, white, yellow, red, and almost black; and the surface is

smooth and even, with the eye scarcely discernible, or deeply indented with innumerable sunken eyes like the rohan and merino. The interior is equally diversified in color, and is mealy, glutinous or watery, and sometimes pleasant, and sometimes disagreeable to the taste. They likewise differ in ripening earlier or later, and in being adapted in some of their varieties to almost every peculiarity of soil. New kinds are produced at pleasure, by planting the seed found in the balls. The tubers obtained in this way will be small the first season, but with careful culture will be large enough the second year to determine their quality, when the best may be selected for propagation. The earliest are easily designated by the premature decay of the tops. The varieties may also be increased from the seed by hybridizing, or impregnating the pistils of one flower by the pollen taken from the flower of another, and in this way some of the best and most valuable kinds have been procured. Such as have no flowers are more productive of tubers, as there is no expenditure of vitality in forming the seed. They may be compelled to flower by removing the small tubers from the stalks as they form.

THE BEST SOIL for potatoes is a rich loam, neither too wet or too dry; but such as are cool and moist, as those of Maine, Nova Scotia and Ireland, especially if in rich, fresh sod, give the best flavored potatoes, and are the least liable to disease. A calcareous soil yields a good potato, and generally a sure crop, and when there is little lime in the soil, it should be added. Salt, ashes and gypsum are excellent manures, and, in certain instances, have astonishingly increased the product. Crushed bones also greatly improve a potato soil. Fresh manures will often unpleasantly affect the taste of the potato, and when necessary to apply it, should be scattered broadcast and plowed in.

THE SEED chosen should be such as experience has decided is best adapted to the soil and the use for which they are to be appropriated. Some are careful to select the most mealy for the table, and plant those which give the greatest yield for their cattle. This is mistaken policy, as what are best for man, are generally

best for cattle; and although the farmer may get a much greater weight and bulk on a given quantity of land of one kind, it may still be inferior in fat and flesh-forming materials to those afforded by a smaller quantity. Thus of three varieties grown in Scotland in 1842, the *cups* gave 13¾ tons per acre, containing $2\frac{9}{10}$ tons of starch; the *red dons* yielded 14¼ tons and $1\frac{5}{10}$ of starch; the *white dons*, 18½ tons and $2\frac{4}{10}$ of starch, and the kidney has even given as much as thirty-two per cent. of starch.—*Johnston.* There is also a difference in the relative proportions of gluten. Of this last, the potato contains in its new and ripe state, about two and one-fourth per cent., which diminishes by long keeping. It is important in this as in an infinite number of other practical matters in the economy of agriculture, to have agricultural laboratories of unquestionable reliability, where the errors of superficial observation may be detected, and where the real superiority of one product over another, and their variations induced by soils, manures and treatment, may be established beyond the possibility of a doubt.

Planting.—To produce abundantly, potatoes require a fertile soil, and if not already sufficiently rich, manure should be spread on the surface before plowing. If a tough sod, it should be plowed the preceding fall, or if friable, it may be done just before planting; but in all cases the land should be put in such condition as to be perfectly loose and mellow. Hills are the most convenient for tillage, as they admit of more thorough stirring of the ground with the cultivator or plow. Medium size, split potatoes have been ascertained from numerous experiments to be the best for planting, and when seed is scarce, it is sometimes economical to quarter them. Six or seven eyes should be placed in each hill, or if in drills, the pieces should be planted ten inches apart. The distance both of hills and drills must depend on the strength of the soil and the size of the tops, some varieties growing much larger than others. Cover with light mold to the depth of four inches, and if the soil be light, leave the ground perfectly level; if cold, heavy or moist, let the hill, or drill be raised

when finished. Subsoil plowing is a great help to potatoes. The sets cut from the seed end give a much earlier crop than those from the root.

Cultivation.—When the plants first appear above the ground, run the plow through them, and throw the earth over them two or three inches, and no injury results if the tops are partially or even entirely covered. The hoe is scarcely required, except to destroy such weeds as may have escaped the plow. The ground should be several times stirred before the tops interfere with the operation, but never after they come into blossom. Enormous crops have been procured by top dressing with compost earth, well rotted chip manure, etc., soon after the plants make their appearance; this is carried to the field and spread from a light, one-horse cart, the wheels passing between the rows; but such results are due to the nicest cultivation, and they would be equally attained by placing the land in the best condition before planting. There is some gain to the crop, when the buds are plucked before they come to blossom.

Harvesting and Storing should not be commenced until the tops are mostly dead, as the tuber has not arrived at full maturity before this time. They may then be thrown out of the hills by a plow, horse potato digger, or some hand implement. They ought not to be exposed to the sun for any length of time, but may dry on the surface in a cloudy day, or be gathered into small heaps with some of the tops spread over them, until freed from the surface moisture, when they may be stored. Those selected for seed should be placed in small piles in the field, or in thin layers in a cool, dry place in the cellar where the air is excluded, and no heating or injury can occur. Such as are intended for consumption may be put in dry bins or barrels in the store room, covered with straw and dry sand, or loose earth to prevent the circulation of air, or buried in the field. Where convenient of access, a hole may be excavated in the north side of a hill, or under a shade in a porous soil. When first stored, the potatoes should be covered for a few days with a slight thatch of straw, so arranged

as to shed the rain. A partial sweating or heating soon takes place, which drives off some of the moisture, after which they may be lightly covered with earth, and in this way they may remain till the commencement of severe frosts, when they should be effectually protected from frost and rain till wanted in the spring. A northern exposure or shade will shield them from any injurious effects of the sun on the approach of warm weather. If stored on level ground, a hole should be excavated for their reception, from one to two feet in depth and four to five in width, and of any length required. The potatoes are then ridged up like the roof of a house, thatched and covered as previously described. A ditch lower than the base must encircle the heap when the soil consists of clay, from which an outlet conducts away all the water, as any left upon them will inevitably produce decay.

DISEASES.—The potato has long been subject to the *curl.* From numerous experiments made in Scotland to avoid this disease, it has been found that seed from potatoes which were gathered before fully ripe, gave a much better and surer crop. It would be well to try the experiment in this country, where there is any deficiency of product from want of full and healthy development. Potatoes are also affected by the *scab* and *grub*, against whose attacks there is no remedy unless in a change of seed and location. *The rot* has for several years produced serious and increasing injury to the potato crop; in 1845, and in several years since, almost threatening starvation in Ireland, and causing great loss and suffering in other countries. Its effects have also been extensively felt in the United States. Numerous and scientific examinations have been made on the subject. The proximate cause is supposed to be a fungus, but what are the reasons for its continued rapid extension, and what may be the remedy for its ravages have not yet been satisfactorily ascertained.

Preventives of Rot.—Under the following circumstances rot has not appeared when adjoining fields have been destroyed by it. 1. By using unripe seed, or seed which has been exposed to the

sun, light and air, and well dried for ten days after digging, and afterwards stored in a dry place in small parcels where air is excluded till the moment of planting. 2. By the use of lime, some of which is placed in the hill and the potatoes dusted with it, and also from the use of charcoal and salt, gypsum or other salts. 3. By the absence of fresh barn-yard manure, or if used, by adding largely of lime or saline manures. 4. The use of fresh sod, which has long been untilled. This has been found more efficacious than any other preventive, although it has occasionally failed. The sod may be plowed in the fall, or it may be left till late in May or early in June, when it has a good coating of grass, and then turned under flat, and furrowed lightly to receive the seed without disturbing the sod. Or they may be planted by using a sharpened stake three inches in diameter, with a pin or shoulder ten inches from the bottom, on which the foot may be placed for sinking the holes. These should be made between the furrow slices at the proper distance for drills, and a single potato placed in each, which may be covered with the heel. 5. Sound, early varieties, early planted, have also escaped.

We have thus secured a good yield, almost wholly free from disease; and even those affected did not appear to communicate disease to others. It has also been found that some very late planted have escaped rot; and if it be an epidemic, it may be that both by early and late planting, the peculiar stage of vegetation when the fungus appears, is in a great measure avoided. But the investigations on this important subject, after many years, are still unsatisfactory, and nothing has thus far been ascertained, which can be justly considered as having determined principles of universal application; yet it is to be hoped that the zeal, intelligence and general interest which are combined for this object may detect what has hitherto evaded the severest scrutiny of scientific research.

Arresting the disease has in some instances been successful, by mowing off the tops when they are found defective. This practice would be injurious to healthy plants, but may be adopted,

like that of cutting grain when struck by rust, if it will secure even a part of the crop. When disease appears in such as are dug, they should be carefully sorted and the sound ones well dried, then placed separately in layers and covered with ashes, burnt clay, or fine dry mold, which act as absorbents of moisture and prevent contagion from such as may be imperceptibly affected. They may also be cut in slices and dried, or crushed, and the farinaceous part extracted. By this means the potato will be made to yield nearly all its nutriment. It is found that this disease affects the tissues (the nitrogenized or albuminous part) of the potato only; and for this reason, potatoes which have not been too long or too deeply injured, will yield nearly their full amount of fat for animals, or starch for the manufacturer.

USES.—Besides being an indispensable vegetable, potatoes are boiled and mixed with flour for bread, to which they impart a desirable moisture and an agreeable flavor. They are sliced, dried, and ground, and much used in Europe as flour, and by the confectioners. They are also manufactured into tapioca, and when nicely prepared, the product is not distinguishable from that of the manioc. In all of these and some other forms, they enter into consumption as human food. They have been also used in large quantities by the manufacturers of starch; to some extent for distilling; and in a less degree for making sugar. The refuse of the pulp after extracting the starch, as well as the liquor drained from it, is used for cleansing woolens and silks, which it effects without injury to the color. But by far the greatest use of potatoes in this country, before they were affected by the rot, was for stock feeding. They are eaten with avidity by all the brute creation, either cooked or raw. For cattle and sheep, they are equally nutritious in either condition. For horses, they are improved by steaming or baking. Swine, and most poultry, will subsist on them raw, but will fatten on them only when cooked. Their good effects are most enhanced by mixing with meal when they are hot, which partially cooks it.

THE SWEET POTATO, (CONVOLVULUS BATATUS,)

Is a root of very general growth in the Southern, and is much cultivated in the Middle sections of the United States, and for the table is scarcely surpassed by any esculent. It is also greedily eaten, and with great advantage, by every species of stock.

We are indebted to an excellent article on this subject, from the U. S. Ag. Department Report, for 1865, by Mr. J. S. Lippincott, of New Jersey:

"Much of the soil of the district of New Jersey is adapted to the growth of this admirable root. No other Northern State produces the sweet potato so abundantly or in as great perfection. In 1862, the Agricultural Department estimated the growth of the sweet potato in New Jersey, at 1,634,832 bushels, valued at $1,226,126. The crop of 1862, thus estimated, surpassed all other Northern and Western States, in aggregate product. Most of the Southern States greatly surpass New Jersey, in the amount of product, North Carolina and Georgia having produced, in 1859, more than 6,000,000 bushels each, Alabama 5,000,000, sundry others from two to four millions of bushels, where it appears to be the great staple vegetable product. Though adapted to a warmer climate, it attains in our State, in favorable seasons, a degree of perfection which leaves nothing to be desired. Such a season was that of 1864, which was remarkable for its product, both in quantity and quality, and for remunerative prices.

"The return of this crop varies from 100, to 200 baskets and upwards per acre, the latter being an exceedingly favorable yield. From six and a half acres there were taken in 1864, 1,700 baskets, which sold for $1,700. Upon three acres 800 baskets (or 500 bushels) were raised, which sold for $1,000. On two acres 600 baskets (or 185 bushels per acre,) was produced in 1864, which yielded per acre, about $300 gross revenue. The above is not, however, a fair exhibit of regular annual returns for the anxious care, the labor and expense, which is sometimes poorly remunerated by an indifferent crop and diminished prices.

"A successful grower has favored us with his method of culture, which we cannot do better than give entire, for the instruction of those who may wish to cultivate this choicest of esculent roots. Moderately good sweet potatoes may be raised further north than New Jersey, on a warm soil, and large crops have been grown in Northern Pennsylvania, where we would not have deemed success could be obtained. The product was not, however, commended to our taste by that flavor and dryness, which result from growth upon a properly selected soil, under a warmer sky. The sweet potato requires a sandy soil or a sandy loam. Land is generally chosen which has been in corn or a vegetable crop the previous year, though it is a common practice to plant the same ground with sweet potatoes, season after season. In the latter they seem to grow as well as they do in freshly chosen ground.

"About the middle of April, the preparation of the hot-beds for starting the sweet potato, for the production of sprouts, is commenced. Having been plowed as for any ordinary crop, but not deeply, the ground is furrowed out with a one horse plow, three feet each way if to be planted in hills, over three and a half feet apart if in rows, the plow running twice in the furrow. A forkfull of horse stable manure is then, if for hills, placed at each intersection of the furrows, and well covered by hand with a hoe. If to be grown in rows, the manure is scattered evenly along the row, and covered by turning two good furrows directly upon it. The field is then ready to receive the plants. The manure should be applied freely, and be of good quality. It should have been well forked over until fine and mellow, to avoid as much as possible, increasing the evil effects of drought, by presenting to the plants their food in lumps, which readily become dry and unavailable, and which, if once in that condition, will certainly remain so throughout the season. When grown in rows a larger number of plants are required than when grown in hills.

"Both methods have their advocates, but if the sprouts are placed from twenty inches to two feet apart in the row, a better crop is generally obtained for the same amount of labor and money

expended. The young sprouts or plants are grown from 'seed potatoes,' selected from the previous year's crop, which shonld be of middle size, and of short, compact shape. These are placed in hot-beds, made up from about the first to the middle of April, in the ordinary way. The manure, fresh from the horse stable, having been evenly shaken into the bed or frame to the depth of twelve or eighteen inches, is pressed down by the weight of the laborer upon a board laid thereon. The board is removed, and the whole evenly covered with about three inches of rather dry sand. Upon this the 'seed potatoes' are carefully placed, close together, though not actually touching, and are then covered with about three inches of good sand or loam. Great care is observed that the right degrees of heat and moisture shall be maintained. If the heat become too great it may be checked by piercing through the bed into the manure with a rake handle, thus allowing the excess of heat to escape. Moisture must be regulated by the watering pot, which should be used on clear days only, and about noon. If the heat or moisture become excessive, the potatoes will rot; deficient heat with moisture may cause the 'black-rot.' If the plants become infected with the latter, it will prove worse than useless to endeavor to use them. Heat and dryness kill the sprouts, or prevent their growth; and even when moderate dryness is combined with other influences favorable to growth, though sprouts apparently good may be produced, they will not possess well developed fibrous roots.

"Experience alone can teach that wisdom in minutiæ which will command certain success. The bed should be exposed to the sunshine on every clear day, and covered with hay or straw at night, and in rainy weather protected from excess of moisture by a covering of boards. The sprouts will be ready for transplanting in about a month, and planting commences from the fifteenth to twenty-second of May, and continues from two to four weeks. When the time for removal has nearly arrived, the plants should be exposed to the open air, to harden them for the field. The sprouts are drawn by taking hold of but one at a time, and gently

extracting it in order to avoid disturbing the mother potato, from which, if undisturbed, a second crop may be obtained. A bushel of good seed, properly managed, will produce 1,200 or 1,500 sprouts at the first pulling, and three-fourths as many at the second. Those obtained later are often as good as the earlier growth.

"Good, strong, stocky plants having been obtained, they are rapidly and expertly transferred to the soil, the operator using no implement but his bare hand. Dashing aside the crown of the hill or ridge, he thrusts his open hand into the yielding sand, and with the other inserts the plant, covers and compresses it, and if the ground is too dry, waters it. In a week or two the field must be examined and re-planted wherever cut worms or other insect larvæ may have destroyed the first setting. Clean culture, with the hand hoe or iron garden rake and horse cultivator, is now required until the vines have covered the ground. About the middle of August the ground should be 'tended' for the last time, by plowing to the rows or ridges, and cleaning up the balks. To perform this thoroughly, the vines must be loosened from the soil to which they have attached themselves by small roots along the main stem, and turned over or out of the way by means of sticks or by the hand. Before gathering the crop, the vines are cut off close to the hill with a sharp hoe. The potatoes are then ploughed out and thrown into rows to dry, when they are readily sorted for market.

"To fit them for preservation they must be lifted before the weather indicates a degree of cold sufficient to freeze the ground, or, in this latitude, before the twenty-fifth of October. Those intended for winter storage should be gathered before the middle of October, put up in barrels or shallow boxes, and placed in a dry, warm situation. When placed in barrels in the open field, and carefully handled, they will be more readily preserved during winter, other circumstances being favorable—slight bruising from rough carriage proving injurious to them, if designed for winter use. When large quantities are reserved for spring sales, houses are erected

expressly for their preservation. These are generally two stories high, built of wood, and so arranged that the potatoes may be stored therein, in boxes about two feet deep, placed in tiers, with spaces of a few inches between for ventilation, and extending from side to side of the house to within a foot of the weather boarding. The source of heat is a fire in the cellar, from which the warmth is caused to circulate equally and freely throughout the building. Thus arranged and carefully tended, maintaining a nearly uniform moderate heat, sweet potatoes may be preserved until late in the following spring. No chaff, shavings, or other material is needed; careful packing and handling, and uniform moderate heat, being the only requisites for the attainment of perfect success in the preservation, for the entire season, of this admirable root."

The foregoing modes of culture, etc., apply to the latitude of New Jersey, and must, of course, be altered, as to the seasons, in other States and sections of the country.

THE TURNIP, (BRASSICA RAPA.)

The common flat English turnip was introduced into this country with our English ancestry, and has ever since been an object of cultivation. When boiled, it is an agreeable vegetable for the table. Its principal value, however, is food for cattle and sheep, by which it is eaten uncooked. Its comparative nutritive properties are small, but the great bulk which can be raised on a given piece of ground, and the facility and economy of cultivation, have always rendered it a favorite with such farmers as have soil and stock adapted to its profitable production and use.

A GOOD SOIL for it is a fertile sand or well drained loam. Any soil adapted to Indian corn will produce good turnips. But it is only on new land or freshly turned sod, that they are most successful. An untilled virgin earth, with the rich dressing of ashes left after the recent burning of accumulated vegetable matter, and free from weeds and insects, is the surest and most productive for a turnip crop. Such land needs no manure. For a sward

ground, or clover lay, there should be a heavy dressing of fresh, unfermented manure before plowing.

Cultivation.—Turnips are sown from the fifteenth of June to the first of August. The first give a greater yield; the last generally a sounder root and capable of longer preservation. The ground should be plowed and harrowed immediately before sowing, as the moisture insures rapid germination of the seed, which is of great importance to get it beyond the reach of insects as soon as possible. This may be sown broadcast, at the rate of one or two pounds per acre, and lightly harrowed and rolled; or it is better to be sown in drills, when a less quantity of seed will suffice. A turnip drill will speedily accomplish the furrowing, sowing, covering and rolling, at a single operation. The crop will be materially assisted by a top dressing of lime, ashes and plaster, at the rate of fifteen or twenty bushels of the first, half the quantity of the second, and three or four bushels of the last, per acre When the plants show themselves, and the leaves are partially expanded, the cultivator or hoe may be freely used, stirring the ground well and exterminating all weeds.

Ruta-baga or Swedes Turnip.—The introduction of this is comparatively recent, and it proves to be more worthy of attention than the English or white turnip. It will bear a heavier soil, yield as well, give a richer root, and it has the great advantage of keeping longer in good condition, thus prolonging the winter food of cattle when they are most in need of it.

Cultivation.—It is usually planted after wheat or corn, but if a fresh virgin soil or old pasture sod is chosen, it will materially lessen its liability to insects and other enemies. It is generally sown in drills, about two feet apart, and on heavy lands these should be slightly ridged. The plants must be successively thinned to prevent interfering with such as are intended to mature, but enough should remain to provide for casualties. Where there is a deficiency, they may be supplied by transplanting during showery weather. They should be left eight to twelve inches

apart in the drills, according to the richness of the soil. The Swede turnip is a gross feeder, and requires either a rich soil or heavy manuring, though the use of fresh manures has been supposed to facilitate the multiplication of enemies. Bones ground and drilled in with the seed, or a dressing of lime, ashes, gypsum, and salt, are the best applications that can be made. The Swede should be sown from about the twentieth of May to the fifteenth June, earlier than the English turnip, as it takes longer to mature, and two or three weeks more of growth frequently adds largely to the product. An early sowing also gives time to raise another crop in case of failure of the first.

ENEMIES.—The turnip is exposed to numerous depredators, of which the turnip flea-beetle is the most inveterate. It attacks the plant as soon as the first leaves expand, and often destroys two or three successive sowings. The black caterpillar, slugs, wire-worms, and numerous other insects, grubs, and aphides, prey upon and greatly diminish the crop.

REMEDIES have been tried to an almost indefinite extent, but none hitherto with more than very partial success. Liberal sowing and rapid growth best insures the plant from injury, and to effect this the seed should be plentifully sown, and if possible, when the ground is moist, and always in a rich soil. The seed should be steeped in some preparation which experience has shown will the most quickly develop the germ. Solutions of the nitrates or sulphates, urine, soot-water, liquid guano, currier's oil, etc., impregnate the first leaves with substances distasteful to their early enemies, and thus a short respite from their attacks will be secured. Gypsum, ashes, bone dust, and poudrette, drilled in with the seed are excellent forcers for the young roots. Charcoal dust applied in the same way has been found to increase the early growth from four to ten fold. When the fly, and bug, etc., is discovered, the application of lime, ashes, or soot, or all combined, should be made upon the leaves while the dew or a slight moisture is on them. This leads the young plant along, and kills such enemies as it reaches. Urine, diluted sulphuric

acid, (oil of vitriol,) and other liquid manures will have the same effect. Ducks, chickens, and young turkeys, and birds, will devour innumerable quantities, and their presence should always be encouraged not only on this but on most of the fields. Dragging the surface with fine, light brush, will lessen the slugs and insects. The ground should be plowed just before winter sets in, which exposes the worms and the larvæ of insects to the frost, when they are unable to work themselves into a place of safety. The seed should not be planted on ground before occupied or near any of the order of plants *cruciferæ*, cabbage, radish, mustard, charlock, and water cress, as they all afford food for the enemies of turnips, and thereby tend to their multiplication.

HARVESTING may be deferred till the approach of cold weather, and in those sections of the country not affected by severe frosts, when on dry soils, they may be allowed to winter on the field. Otherwise they should be secured during the good autumnal weather. This is accomplished most expeditiously with a root hook, which is made with two iron prongs attached to a hoe handle. The use of a bill hook or sharp knife, will enable the operator to lop off the leaves with a single blow, when they are thrown into convenient piles and afterwards collected for storage.

THE STORING may be in cellars or in heaps, similar to potatoes, but in a cooler temperature, as slight heat injures them, while frost does not. If stored in heaps, one or more holes should be left at the top, which may be partially stopped by a wisp of hay or straw, to allow the escape of the gases which are generated.

THE FEEDING of ruta-bagas to cattle and sheep, is always in their uncooked state. They are better steamed or boiled for swine, but their food should be sought from the more fattening products of the farm. In moderate quantity they may be given to horses, but they cannot be relied upon for them, as they are too bulky for working animals. Their place is much better supplied for horses by the carrot or potato. Their true value is as food for store and fattening cattle, milk cows and sheep, as they furnish a salutary

change from dry hay, being nearly equivalent as a fodder to green summer food. They should be washed before feeding if too much dirt adheres to them, but if grown on a light soil, the tap roots lopped off and otherwise properly secured, they will not require it. They may be sliced with a heavy knife, or more summarily cut up while lying on the barn floor, with a sharp spade, or root slicer, which is made with a socket handle and two blades crossing each other in the center at right angles, or by some of the numerous improved cutting machines, which are much better. With an abundance of turnips and a small supply of straw, hay may be entirely dispensed with for cattle and sheep. Many of the best English breeds are kept exclusively on turnips with a little straw till ready for the shambles.

THE VARIETIES of turnips are numerous. After selecting such as will give the largest crop of the most nutritious roots, the next object in the choice of particular varieties should be to adapt them to the most economical use. Some will keep much longer than others, and if wanted to feed late in the season it may be necessary to take a variety intrinsically less valuable than another which must be earlier consumed. The English turnip should be first fed as it soonest wilts and becomes pithy, then follow with the others according to their order of maturity and decay. The leaves yield good forage, and if unmixed with earth may be fed dry or green to cattle.

The value of turnips to this country, is trifling in comparison with that of many parts of Europe. In Great Britain alone, this value probably exceeds one hundred millions of dollars annually. But its culture here is less desirable, as our dryer climate and early and severe winters are not as well adapted to its production and economical preservation and feeding as those of England, and its numerous enemies render it an uncertain crop. These objections are increased by the important fact, that it enters into competition with our Indian corn, which, under ordinary circumstances, always gives a certain and highly remunerating return. It may sometimes, however, take the place of corn, with advantage, and the

turnip or some other roots should always occupy a conspicuous place in the change of winter food for cattle and sheep.

Turnips are *cold* food, and not recommended to be fed during very severe winter weather. We have had calves and other young stock severely scoured by them. The best use for turnips is for *lambing* ewes before grass comes.

THE CARROT, (DAUCUS CAROTA,)

Is one of our most valuable roots. It is a hardy, easy cultivated plant, and grows in almost every soil, and is next to the potato in its nutritive properties.

THE SOIL which best suits it is a fertile sand or light loam, but it will grow on such as are more tenacious, if well drained, and deeply worked. The success of this and the parsnip depends much on the depth to which their roots can reach. Deep spading or subsoil plowing is, therefore, indispensable to secure large crops, and nearly all kinds of manure are equally suited for their food, if well rotted. The ground should be thoroughly pulverized.

THE VARIETIES chiefly used for field culture, are the long red, the orange, and white Belgian. The last, under favorable circumstances, attains huge dimensions, and from its roots growing high out of the ground, it is supposed to draw more of its nourishment from the air, and to exhaust the ground less, while it is of course, more easily harvested. But it is considerably below the others in comparative value.

PLANTING.—The carrot should be sown in drills, sixteen to twenty inches apart, when the ground has become warm and dry. The seed is best prepared by mixing with fine mold or poudrette, and stirring them well together to break off the fine beards; then sprinkle with water and allow it to remain in a warm place, and occasionally turn it to produce equal development in the seed. It may remain ten or fifteen days before sowing, till nearly ready to sprout. It then readily germinates, and does not allow the weeds to get the start. The frequent use of the cultivator and entire cleanliness from weeds is all that is

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necessary to insure a crop, unless it be convenient to give it a top dressing of liquid manure, which the Flemings always do, and which no crop better repays. Two pounds of good seed will sow an acre. Any deficiency of plants may be supplied by transplanting in moist weather. Six inches is near enough for the smaller kind to stand, and eight for the larger. They are subject to few diseases or enemies, excepting such as can be avoided by proper selection of soil and careful tillage.

THE HARVESTING may be facilitated by running a plow on one side of the rows, when the roots are easily removed by hand. The tops are then cut and the surface moisture from the roots dried, when they may be stored like turnips and potatoes. They ought to be kept at as low a temperature as possible above the freezing point. On the approach of warm weather they will sprout early if left in heaps, and if important to preserve them longer, the crown should be cut off and the roots spread in a cool, dry place.

USES.—Carrots are chiefly grown for domestic stock. Horses thrive remarkably on them, and some farmers feed them as a substitute for oats. But their intrinsic value in weight, is less, in the proportion of about five to one. They are good for working cattle and unsurpassed for milk cows, producing a great flow of milk and a rich yellow cream. Sheep and swine greedily devour them, and soon fatten if plentifully supplied with them. The Dutch grate them, and with sugar and salt, make a pickle for their choicest table butter. They are also employed in distilling. The average yield on good land may be estimated at about three hundred bushels of the smaller, and four hundred and fifty of the Belgian or white, per acre, but with extra cultivation, one thousand bushels of the last have been raised.

THE PARSNIP, (PASTINACA SATIVA,)

Is cultivated as a field crop, and is of nearly equal nutritious value with the carrot. *The soil* may be heavier for parsnips than for carrots, and they will even thrive on a strong clay, if

rich, well pulverized, and dry. Large crops can only be obtained on deep, rich ground, well pulverized. They should be sown early, as frosts do not affect them, and they require a long time to come to maturity. Drilling at a distance of twenty inches apart, is the proper mode of planting, and they should be thinned to a space of six or eight inches. It requires four or five pounds of seed per acre, which must be of the previous year's growth, as older does not readily vegetate. No preparation of the seed is necessary. The subsequent cultivation is similar to that of carrots, and they will generally yield more under similar circumstances of soil and tillage. They are little subject to disease or enemies.

THE GATHERING should be deferred till the frost leaves the ground in spring, unless wanted for winter's use, as they keep best in the ground, where they are uninjured by the heaviest frost. But particular care should be observed in allowing no standing water on them, or they will rot. When taken up in the fall, the roots should neither be trimmed nor broken, nor should the tops be cut too near the root. They should be stored out of doors, in a dry place, and covered carefully with earth, so that they can thoroughly freeze, as exposure to air, or even moderate heat, wilts them.

USES.—The parsnip is one of our most delicious table vegetables. It is an excellent food for swine, either raw or cooked, and for cattle, milk cows, and sheep, it is highly prized. Qualey says, "it is not as valuable for horses, for though it produces fat and a fine appearance, it causes them to sweat profusely, and if eaten when the shoot starts in the spring, it produces inflammation in the eyes, and epiphora, or weeping." The leaves of both carrots and parsnips are good for cattle, green or dried. Gerarde, who wrote in 1596, says, "an excellent bread was made from them in his time." They have also, like the carrot, been used for distillation, and are said to afford a very good vinous beverage. The *best variety* for field culture is the large Jersey.

THE BEET, (BETA.)

There are two varieties of the beet in general use for the field: the sugar beet and mangel-wurzel, both of which have several sub-varieties. They are of various colors, red, pink, yellow, white or mottled, but color does not seem to affect their quality. The conditions under which they grow, are similar. Beets do well in any soil of sufficient depth and fertility, but they are perhaps most partial to a strong loam. If well tilled, they will produce large crops on a tenacious clay. We have raised at the rate of eight hundred bushels to the acre, on a stiff clay, which had been well supplied with unfermented manure. The soil cannot be made too rich. For such as are adhesive, fresh or unfermented manures are much the best.

THE PLANTING should be in drills twenty to twenty-four inches asunder, at the rate of four to six pounds of seed per acre, buried not over one inch deep. The seed should be early planted, or as soon as vegetation will proceed rapidly, but must first be soaked by pouring soft scalding water on it, allowing it to cool to blood heat, and remain for three or four days, then roll in plaster and drill it in. The husk, or outer covering of the seed, is thick and impervious to moisture, and without a thorough, previous saturation, will not readily germinate.

THE CULTURE is similar to that of carrots and parsnips. They should be thinned to a distance of about eight inches to a foot, according to the kind, and all vacancies filled up with strong, thrifty plants. It is better to sow thick enough to avoid the necessity of transplanting, for in addition to the time and expense of this operation, it puts them back some days in their growth, although such plants will thrive as well as those which grow in their ranks from the seed. The above distances are suitable for the sugar beet; the mangel-wurzel attains a larger size, and the spaces may be increased to a foot apart. The practice of plucking off the leaves for cattle feeding, is objectionable, as it materially interferes with the growth of the plants.

Scarcely any disease or enemy troubles it, except when young. It is then sometimes, though rarely, attacked by grubs or small insects.

HARVESTING may be commenced soon after the first leaves turn yellow, and before the frosts have injured them. The tops must not be too closely trimmed, nor the crown of the roots or its fibrous prongs cut from such as are destined for late keeping. If intended for early winter use, they may be abridged a trifle, and after the surface is dry, stored like other roots. They do not need as effectual protection as potatoes, for if the frost touches them under a covering of earth, it will gradually be withdrawn on the approach of warm weather, and leave the roots uninjured; but they will not keep as long as if untouched by the frost. A slight opening for the escape of the gas, as with the other roots, should be left at the top and partially guarded with straw.

USES.—The beet is a universal favorite for the table and of great value for stock. Domestic animals never tire of it, and swine prefer it to any other root excepting the parsnip. We have often kept swine in the best condition, through the winter, on no other food than the raw sugar beet. They possess additional merit from their capability of resisting decay longer than the turnip, and frequently beyond the carrot and parsnip. They will be solid, fresh, and juicy, late in the spring if properly stored, and at a time, too, when they are most wanted for ailing sheep or cattle, milk cows, or ewes, or for contributing to the support and health of any of the ordinary stock. When fed to fattening animals, they should follow and never precede the turnip. It has been found that such animals continue steadily to advance in flesh after being carried to a certain point with turnips, if shifted on to the beet, but in repeated instances they have fallen back if changed from beets to turnips. Davy found in 1,000 parts, the following quantity of nutritive or soluble matter: White, or English turnips, 42; Swede, 64; mangel-wurzel, 136; sugar beet, 146. This order of nutritive quality is followed by Bous·

singault, though he places the field beet and Swede turnip at nearly the same point. Einhof and Thaer, on the contrary, place the Swede before mangel-wurzel. But in feeding to animals, unless for an occasional change, the roots should be given out in the order named. The sugar beet is seen to be more nutritious than the mangel-wurzel; it is equally hardy and productive, and more palatable to stock, and of course is to be preferred for raising. The former has been largely cultivated in France and Germany, for making into sugar, where it has been entirely successful, because protected by an adequate impost on the imported article. Their conversion into sugar has repeatedly been attempted in this country, and of late with flattering prospects of success. It may, possibly, sustain a successful competition with the cane. From the experiments of M. Darracq, it has been found, that in summer the best yielded from three and a half to four per cent. of sugar, but in October, after the commencement of frost, it gave only syrup and saltpeter, and no crystalizable sugar. When used for this purpose, the residuum of the pulp after expressing the juice, is given to cattle. When wilted, the leaves are also fed to them, but caution is necessary to prevent their scouring. What are not thus used are plowed in for manure. The beet is also distilled, and yields about half the product of potatoes.

The beet is no doubt the surest and best crop for stock feeding in America, particularly to milk cows and breeding ewes, as it largely promotes their flow of milk, and keeps their bowels free.

THE JERUSALEM ARTICHOKE, (HELIANTHUS TUBEROSUS,)

A native of Brazil, is a hardy plant, but little cultivated. Loudon says the name Jerusalem is a corruption of the Italian word *girasole*, (or sun-flower,) the blossom of which it closely resembles, except in size. It flourishes in a moist, loose soil, or sandy loam, with little care except to thin out and prevent weeds. It is very productive, and easily cultivated in drills, three or four feet apart. The planting may be done in March or April. As

it is not injured by frost, and is very prolific, it will spread rapidly and often becomes a pest in the garden. The product is enormous, sometimes amounting to several hundred bushels per acre. Its nutritive qualities are much less than those of the potato, but its great productiveness and the facility of raising it, would seem to commend it to more general favor. Boussingault considers it an improving and profitable crop, from its drawing its nitrogen largely from the atmosphere. It is peculiarly fitted for a spring feed, as the roots lie uninjured by the vicissitudes of the weather, and may be taken out in perfection after most other roots are gone.

THE USES of the Jerusalem artichoke in this country, are both for human and animal food. The roots are generally used as a pickle or salad. Loudon says, "they may also be eaten boiled, mashed in butter, or baked in pies, and have an excellent flavor." The tops when cut and cured as hay, afford a good fodder for cattle, and the roots are excellent for sheep and other stock. Swine will thrive upon them through the winter, and do their own harvesting when the ground is not locked up by frost.

NOTE.—We give on the following page a table of the nutritive equivalents of food, compiled by Boussingault, as a convenient reference, though not entirely reliable in all cases. For it will be seen from what has before been said, that the particular plants vary not only according to the season and soil, but also frequently, according to the particular variety subject to analysis. He says: "In the following table, to the numbers assigned by the theory, I have also given the standard quantity of water, and the quantity of azote, contained in each species of food. The details of my experiments, and the precautions needful in entering on and carrying them through, must have satisfied every one of the difficulties attending their conduct. In my opinion, direct observation or experiment is indispensable, but mainly, solely as a means of checking within rather wide limits, the results of chemical analysis."

NUTRITIVE EQUIVALENTS OF DIFFERENT KINDS OF FORAGE.

	Standard water per ct.	Azote, per ct.	Azote per ct. in the article not dried.	Theory.
Ordinary natural meadow hay,	11.0	1.34	1.15	100
Ditto, of fine quality,	14.0	1.50	1.30	98
Lucern hay,	16.6	1.66	1.38	83
Red clover hay, 2d year's growth,	10.1	1.70	1.54	75
Red clover, cut in flower, green do.,	76.0	....	0.64	311
New wheat straw, crop 1841,	26.0	0.36	0.27	426
Old wheat straw,	8.5	0.53	0.49	235
Do., do., lower parts of stalk,	5.3	0.43	0.41	280
Do., do., upper part of do. and ear,	9.4	1.42	1.33	86
New rye straw,	18.7	0.30	0.24	479
Old ditto,	12.6	0.50	0.42	250
Oat straw,	21.0	0.36	0.30	383
Barley ditto,	11.0	0.30	0.25	460
Pea ditto	8.5	1.95	1.79	64
Millet ditto,	19.0	0.96	0.78	147
Buckwheat ditto,	11.6	0.54	0.48	240
Vetches cut in flower and dried,	11.0	1.16	1.14	101
Potato tops,	76.0	2.30	0.55	209
Field beet leaves,	88.9	4.50	0.50	230
Carrot ditto,	70.9	2.94	0.85	135
Jerusalem artichoke stems,	86.4	2.70	0.37	311
Canada poplar shoots,	62.5	2.29	0.86	134
Oak ditto,	57.4	2.16	0.92	125
Drum cabbage,	92.3	3.70	0.28	411
Swedish turnip,	91.0	1.83	0.17	676
Turnip,	92.5	1.70	0.13	885
Field beet, 1838,	87.8	1.70	0.21	548
Ditto, white Silesian,	85.6	1.43	0.18	669
Carrots,	87.6	2.40	0.30	382
Jerusalem artichoke, 1839,	79.2	1.60	0.33	348
Ditto, 1836,	75.5	2.20	0.42	274
Potatoes, 1838,	65.9	1.50	0.36	319
Ditto, 1836,	79.4	1.80	0.37	311
Ditto, after keeping in the pit,	76.8	1.18	0.30	383
Cider apple pulp dried in the air,	6.4	0.63	0.59	195
Beet root magma, from sugar mill,	70.0	....	0.38	303
Vetches in seed,	14.6	5.13	4.37	26
Field beans,	7.9	5.50	5.11	23
White peas, dry,	8.6	4.20	3.84	27
Kidney beans,	5.0	4.30	4.58	25
Lentils,	9.0	4.40	4.00	29
New maize,	18.0	2.00	1.64	70
Buckwheat,	12.5	2.40	2.10	55
Barley, 1836,	13.2	2.02	1.76	65
Barley meal,	13.0	2.46	2.14	54
Ditto,	13.0	2.20	1.90	61
Oats, 1838,	20.8	2.20	1.74	68
Ditto, 1836,	12.4	2.22	1.92	60
Ditto, Parisian,	14.0	1.93	1.70	68
Rye, 1836,	11.5	1.70	1.50	77
Ditto, 1838,	11.5	2.27	2.00	58
Wheat, 1836, Alsace,	10.5	2.33	2.09	55
Ditto, 1838,	14.5	2.30	2.00	57
Ditto, from highly manured soil,	16.6	3.18	2.65	43
Recent bran,	37.1	2.18	1.36	85
Wheat husks or chaff,	7.6	0.94	0.85	135
Rice, Piedmont,	13.4	1.39	1.20	96
Linseed cake,	13.4	6.00	5.20	22
Hemp, ditto,	5.0	4.78	4.21	27
Beech mast, ditto,	6.2	3.53	3.31	35
Dry acorns,	....	....	0.80	143
Refuse of the wine press, air dried,	48.2	3.31	1.71	68

CHAPTER X.

FRUITS.

The growing of fruits to the extent at least of the demands for his own use, should never be neglected by the farmer. The soil and climate of the United States are almost everywhere suited to their cheap and easy production. They are a source of profit for market purposes as well as useful to stock; and they afford some of the choicest and most economical luxuries for domestic use. Success in their cultivation may at all times be secured by a careful selection of the fruit, the soil, and location, and by proper attention thereafter.

From a long course of observation, we are satisfied that there are no articles of cultivation on the farm so refining in their influences upon the household as those of fruit. They are sources of health as food, of luxury in their flavor and variety, of economy in household consumption, of pleasure in their production, and of boundless interest in their study and propagation.

The first thing which a farmer should do after providing for the *necessities* of his household on the farm which he is founding for a home, if not already provided, should be liberal plantations of fruit in all the varieties which his family necessities require, and the soil and climate will readily produce. Aside from their important domestic uses and profit as market crops, they adorn and beautify the farmer's home with an expression of comfort, wealth, abundance, and hospitality, to say nothing of the good taste they indicate in the proprietor, as well as adding largely to the actual value of the premises either for occupation, or the sale of the estate, if by any train of circumstances a sale becomes necessary.

In our enumeration of the fruits we begin with that, which in a great majority of the United States, is the most used, and valuable.

THE APPLE.

The locality of the apple orchard should depend much on the climate and soil. In warm latitudes, a northerly exposure is perhaps best when not subject to violent winds, as these from any quarter are liable to blast the fruit while in blossom, and blow it from the tree before it is ripe. It is generally advantageous to protect an orchard from the bleak winds which prevail in its immediate neighborhood, by a proper selection of the ground. A warm and sunny position subjects the buds in spring to premature swelling, and these are often cut off by the severe spring frosts that follow, when an ordinary or northern exposure would retard their budding until the season is sufficiently advanced for their protection. The orchard should have a medium position as to exposure and the influences of the season.

Soil.—All the varieties intermediate between a stiff, unyielding clay and a light shifting sand, are friendly to the apple. The soil best suited to the perfection of fruit is a moist, friable, calcareous loam, slightly intermixed with fine gravel. This may run either into a sandy loam, which usually rests upon a subsoil of sand or gravel; or into a clayey loam with a subsoil of stiff clay. Either of these is a good soil for the orchard. The ground should be rich enough for the production of good crops of grain, roots or grass. This state of fertility is absolutely necessary for the thrifty growth of the tree, and its existence in a healthy and vigorous state.

Springy or wet land is decidedly bad for an orchard, and if the farmer can appropriate no other for this purpose it should be thoroughly tile drained to the depth of three to four feet, so as to leave the soil perforated by the roots, in a warm and active state. Rocky and stony soils of the above descriptions are usually well adapted to the growth of fruit trees. The stones keep the ground moist, loose and light. Some of the finest fruits grow

where there is scarcely room to deposit the tree between the huge rocks. They should not however lie too deep when close together, as they will impede and control the growth of the roots. A sufficient area of earth is always necessary for an ample growth of wood and the full size of the tree at maturity. Stiff clays and light blowing sands under very nice cultivation will grow fruits, but they require active manure. Clays should be often plowed while the trees are young, particularly in the fall, that the soil may be ameliorated by the winter frosts. The sands require compact culture, and appropriate manures. All such as are suited to ordinary crops on these lands will promote the growth of trees. The use of other soils however for the orchard should be preferred, as the fruit will be larger, fairer and better flavored, and the trees of much longer duration.

Planting.—Dig the holes from three to six feet in diameter, and twelve to eighteen inches deep, according to the kind of soil and the size of the tree. The more compact the soil, the deeper and larger should be the hole. When ready to plant, let enough of the best or top soil be thrown into the bottom of the hole, so that the tree may stand about one inch lower than when removed from the nursery. The tree should be taken up so as to injure the roots as little as possible. If any be broken, cut them off, either square or obliquely with a fine saw or sharp knife. If left in their bruised or broken condition, they will canker and decay in the ground, but if thus cut off, numerous rootlets will spring out at the termination of the amputated root, which strikes into the soft earth and give increased support to the tree. If the soil be poor, the roots should be covered and the holes filled with good earth. If the hole be small, the surrounding land hard, and the roots bent up and cramped, the trees cannot grow, or if after a long time of doubt and delay, it finally survives, it creeps along with a snail's pace, making little return to the planter. If the tree be crooked, confine it with a straw band to a stake firmly planted in the ground. This is the best ligature, as it does not cut the bark, which small cords often do. and it gradually gives

way as the tree increases in size. When thus planted, well manured and looked after subsequently, the tree thrives, and in a few years rewards the owner with its delicious and abundant fruit.

The season of planting may be any time after the fall of the leaf by frost in autumn, till its reappearance in the spring, provided the ground be not frozen. Early spring is to be preferred for planting *stone* fruits. They may be planted while in embryo leaf and blossom with entire success, but it is usually best to do this before the bud is much swollen. If one time be equally convenient with another, we recommend spring planting for fruit generally, as the earth then becomes settled about the root early in the season. Yet, on light soils, fall planting may be equally advantageous with all excepting *stone* fruits. This is particularly advantageous when the spring is succeeded by a severe summer's drought. So important is the operation of planting, that it is better to have one tree well planted, than three planted badly, and more fruit may be anticipated within the first ten years, if not forever, from the first one than from all the others. It sometimes occurs that in removing trees from a great distance, they arrive too late in the fall to be properly transplanted. In such case a trench should be dug in soft earth and the trees laid at an angle of about 45°, three or four inches apart, the roots carefully placed to prevent breaking, and the earth piled on them for a foot up the trunk, and eight or ten inches over the roots. This will preserve them until spring without detriment to their future growth. The practice is adopted by nurserymen and others, who often transplant their trees from one location to another without loss or difficulty. Trees should never be planted in the apple orchard at less distance than two rods, and forty feet apart is better. Close planting prevents the trees from receiving the requisite quantity of sun and the free circulation of air, both of which are essential to the size, flavor and perfection of fruit. Forty trees will plant an acre, at the distance of two rods apart. The consequence of closer planting is the premature decay of the trees and an inferior

quality of fruit. Some planters advocate much closer planting, on the plea that when the trees grow larger and become too close, a part of them can be removed, but we have seldom seen one who had the hardihood or courage so to destroy them. Better plant them at a suitable distance at first.

Cultivation.—A previously uncultivated or virgin soil is the best for an orchard, but if such is not to be had, that which has been long in pasture or meadow is most suitable. The most efficient manures are swamp muck, decayed leaves and vegetables, rotten wood, chip manure, lime, ashes, gypsum, etc. Trees, like any other vegetable, draw their own specific food largely from the soil, and to supply the elements of their growth in abundance, the earth should occasionally be renewed with those materials which may have become partially or wholly exhausted. When carefully plowed and cultivated in hoed crops, orchards thrive most rapidly, care being always taken to protect the trees from damage either to the trunks or roots. All tearing of the roots is objectionable. The ground should be kept rich and open, so as to be pervious to the influence of rains, the sun and the atmosphere. Under these conditions the trees will thrive vigorously.

When lands are kept in grass, a space of three to six feet in diameter, according to the age and size of the tree, should always be kept free from turf around them. Pastures which are trodden by animals, are so bared by this and the closeness of their cropping, when they can do so without browsing or injuring the trees and fruits, that the roots of the trees get their share of benefit from the sun and rains. From this cause pastures are better suited to orchards than mowing lands; for the latter are so completely covered by the rank growth of grass that the tree suffers, and without the aid of manures and the annual loosening of the ground for a few feet around, the tree in some cases dies from exhaustion. All kinds of cereal grains are bad for orchards, except perhaps buckwheat. The preparation of the ground for this crop, by early summer plowing, is highly conducive to the growth of trees, and its nutriment being drawn largely from the air, it robs the roots of a small amount only of the materials in the soil.

A neighboring farmer, whose management many years since came under our notice, had a small mowing lot adjoining his barn and cattle sheds, which was surrounded with a stone wall. The soil was a moist gravelly loam, every way fitted for the growth of apple trees, as was shown by there having been several flourishing orchards on similar soils in the immediate vicinity. He filled this with apple trees, set in small holes at the proper distances, the rows terminating on each side close to the wall and also near his barn and sheds. After setting out, the trees were staked and then left to grow, as best they could without farther cultivation. Those remote from the wall and buildings remained nearly stationary for several years, while those under their influence, after two or three years began to show a vigorous growth. The grass was cut and removed annually, and the trees received no cultivation, save perhaps a bushel or two of chip manure occasionally thrown around them. Twenty years after they were planted, the trees next to the wall and buildings were thrifty and had attained a large size, while many of the others had died, a few had grown to one-fourth the size of the outer ones, and others were still smaller, mossy, and showing signs of a premature old age. Not one-third of the trees gave any return whatever. The wall and buildings kept the soil next them light and moist, while that in the more open field spent all its energy upon the grass. An orchard to be productive and profitable, *must be cultivated*, and without this, it is useless to plant it.

Pruning.—This operation should commence at the planting of the tree, the top of which should always be in proportion to the size and number of the roots. If the top be high and spindling, shorten it so as to throw the lateral shoots into a graceful and branching form. The limbs may commence about six feet from the ground. The pruning should be done annually, as the labor is then trifling, and the expenditure of vital force in maturing wood which is afterwards to be cut off is thus saved, and the branches to be removed being small the wounds readily heal. In this case no covering is required for the wound as one or two

season's growth will heal it. The top should be sufficiently open to admit the sun and air. The best time for trimming is when the tree is in bloom, and the sap in full flow. The proper instrument is a fine saw or sharp knife, and the limb should be cut off close to the remaining branch. The sap at this time is active, and is readily converted into new bark and wood, which speedily forms over the cut. But this is a busy season with the farmer, and if he cannot then prune his trees he may do it when more convenient, taking care to secure the wounds by an efficient covering of salve. *Old trees*, or such as are growing vigorously and have been long neglected, often require severe trimming, which should always be done in May or June, and when the wounds are large they should be covered with a coat of thick Spanish brown paint or grafting wax. If they are left exposed and the growth of the tree be slow, decay will often take place before they are healed. Too much care cannot be used in these operations. In large trees, a ladder should always be at hand to avoid breaking the limbs by the weight of the operator. If by too close planting the branches of different trees be brought into contact, thorough pruning is absolutely necessary, as without it good fruit cannot be obtained; or, a better way is to remove some of the trees altogether.

Grafting and Budding.—These operations are so simple, and usually so well known by some individual in every farming neighborhood, that no written description of either operation is necessary. *Grafting wax* of the best kind is thus made: Take four parts of rosin, one of tallow and one of beeswax, melt and stir them well together, then pour them into a bucket or pan of cold water. As soon as cool enough to be handled, work it over and draw it out like shoemaker's wax, until it is entirely pliable. It may then be used immediately or laid up and kept for years. The mode of applying it is known to every grafter. *Scions* should always be of the growth of the preceding year and cut from well ripened, thrifty wood, in the months of January, February or March, before the buds begin to swell with the flow of the spring

sap. Tie them up and keep in a moist, cool place, a cellar bottom, or box of moss or earth, till ready for use. When circumstances require it, grafts may be cut at any time after the fall of the leaf, but the months indicated are best in all localities north of the Potomac and Ohio rivers. July and August are the best time *for budding*. This should always be done while the sap is in flow and the bark is loose, as at no other time is success certain.

SELECTION OF TREES.—These should always be selected from seedlings. Suckers from the roots of grown trees are objectionable as tending to throw up suckers themselves which are always troublesome. When they appear, these should be cut close to the root or stem, and if properly done, they will rarely sprout anew.

In our opinion, decidedly the best trees for orchard planting, and long endurance, are *natural* stocks, grown to planting size, and grafted a year or two after their growth in the orchard is secured. The reason is this: being *wildings* they are of no particular variety, usually hardy in their wood, and compact in its growth. Thus they are tough and strong in fibre, with vigorous roots. All choice fruits, with perhaps a few exceptions, are refined and delicate in their wood, as well as in their fruits, less hardy to resist outside influences of the sun and atmosphere, and less robust in the trunk. Therefore when the choicer and more refined woods are grafted upon them at branch height, their leaves protect their own wood, which is better sustained by the vigorous sap of the wilding below. On the other hand, in the common way of nursery grafting, at or near the root while very young, although closely grown in the nurseries where they protect each other, and make an apparently healthy, clean and vigorous growth, when transplanted into the orchard they are more liable to casualty, and prove much shorter lived than the wildings.

In the earlier settled States, in our boyhood, fifty years ago, we knew old orchards of choice apples, that when young, were grafted *branch high*, which history and tradition gave an age of eighty or a hundred years, still in vigorous bearing and of eighteen

inches to two feet in diameter. Some of those trees are still living; while since that time *root* grafted trees have been planted, lived out their time of bearing, and decayed, and with better cultivation than the ancient trees ever received. It may be argued by the nurserymen and others, who maintain the better plan of early root grafting, that the later planted trees may have lacked the pabulum of tree growth, which the early orchards, planted in a virgin soil, contained. It may to some extent be so in the older sections of the country, but root grafted trees, on the newer lands show the same shorter lived propensity. We do not decide the *theory;* the *fact* is all that we notice; but were we left to a choice, our selection would be those of the natural or wilding stocks, with *head* grafting afterwards.

PLANTING THE SEED.—If the farmer wish to raise his own trees he can sow the seed or pomace in rows in the fall. After they come up in the spring, weed and hoe them like any vegetable. When a year old, they should be carefully taken up, the tap root cut off and re-planted in rows four feet apart, and at least a foot distant in the rows, when they should be regularly trimmed and cultivated till they are one and one-half or two inches diameter at the base, at which time they are fit for the orchard. These operations are however the appropriate business of the nurseryman, for whose guidance there should always be at hand, some standard work on the cultivation of fruits. Of these there are several valuable American authorities.

GATHERING AND PRESERVING.—For immediate use, apples may be shaken from the tree. For winter consumption or packing for market, they should be carefully picked by hand with the aid of ladders, to avoid bruising the fruit and injuring the limbs. To preserve apples, the best method is to lay them carefully into tight barrels or boxes, immediately after picking, and after being lightly shaken or pressed together. They may then be tightly headed, with the head heavily pressed down and secured, for marketing, or covered so as to exclude the air, when intended for family use. The boxes or barrels should then be put away into

a dry place, and kept as cold as possible above the freezing point. But if slightly frozen, they will not be injured if suffered to remain unpacked till the frost leaves them. Thus managed, they will keep as long as they are capable of preservation. Bins in a dry cellar are good for ordinary use if closely covered. If exposed to the air, warmth, or moisture, apples soon decay. If too dry, they wilt and become tasteless. They are sometimes buried in the earth like potatoes, but this is very liable to impair the flavor and give them an earthy taste; and they seldom keep so well after removal in the spring as when they have been stored in barrels.

For farm stock, apples are extremely profitable, and the better the quality of fruit the more valuable are they for this object. When so fed they should, like roots, be cut to avoid choking. A variety of both sweet and sub-acid should be cultivated. The saccharine matter of the apple is the principal nutritive property, and this abounds in some kinds of the sub-acid. Animals like a change in their food as well as man, and both these varieties should, therefore, be fed to them alternately. When the soil and climate are adapted to them, we have no doubt that apples for stock, can be grown cheaper than any other kind of food, excepting grass. Hogs have been often fatted upon them cooked, with grain meal intermixed; and when fed to horses, neat cattle, and sheep, with hay, they are almost equivalent to roots. That tree must be badly cultivated which in ten years after planting, will not produce five bushels of apples; and these, at ten cents a bushel, give an annual revenue of fifty cents a tree, or twenty dollars per acre for stock feeding alone. At twenty years old, the tree will double that product, casualties excepted, and as this estimate is based on their least valuable use, an increased profit of course may be anticipated from their conversion to other purposes. Good apples are rarely worth less than twenty-five cents a bushel in market; often three or four times that amount. The ranging of swine among any kind of fruit trees greatly conduces to their health and growth.

Besides the support of the swine, their consumption of windfalls secures the destruction of the insects in them. Sheep, turkeys, ducks, and chickens, answer the same purpose when suffered to frequent them in sufficient numbers. For stock feeding, sweet apples are best.

Best Varieties of Apples for Cultivation.—Almost every section of the apple growing region of America has a greater or less variety peculiar to itself, and their valuable properties appear more fully developed in these localities than when removed to others. Such should of course be retained when of extraordinary excellence. There are varieties, however, which are of more general cultivation, cosmopolites throughout the apple climates, of fine quality, and possessing all the excellence of which the genus is capable. Thirty different kinds for each section or State, will probably include all which it is desirable to cultivate, and for any one location perhaps twenty is sufficient. We name some standard varieties, all of which are now in successful cultivation in different parts of the United States and the Canadas. The names and descriptions are found in the current fruit books and nursery catalogues of the day.

Summer Apples.—Early Harvest, Red Astracan, Large Yellow Bough, Williams' Favorite.

Autumn Apples.—Golden Sweet, Fall Pippin, Gravenstein, Jersey Sweeting, Rambo.

Winter Apples.—Westfield Seek-no-farther, Baldwin, Yellow Belle Fleur, Hubbardston Nonesuch, Northern Spy, Peck's Pleasant, Rhode Island Greening, American Golden Russet, English Russet, Roxbury Russet, Swaar, Talman's Sweeting, Esopus Spitzenberg, King.

These varieties are unimpeachable in Western New York, which probably is the best and most exclusively *market* apple producing country in the Northern States. But the most experienced orchardists there confine their attention to a very few winter varieties, of which the Baldwin, Greening, and Roxbury Russet are the chief, as being hardy in the tree, thrifty in growth, and sure and abundant bearers.

Still there are wide sections of country where apples thrive well, and the kinds we have mentioned are not successful, or if they do grow, their fruit becomes changed in flavor, size, time of ripening, and productiveness, induced by a change of soil and climate.

These different soils and localities have, too, their own peculiar and good varieties, either originating there, or amenable to their condition; and such varieties, when successful, should there be cultivated. We cannot specify the names of such different kiuds as a sure guide to all. But under one general remark to those who contemplate apple orchard planting, we say: look around and ascertain what are the best fruits successfully cultivated in the vicinity; or if an entirely new country, what varieties grow and are successful in like soils and climate, and then adopt them. With such a guide, no one need be at much loss in raising excellent fruits for all necessary purposes. The catalogues now annually distributed broadcast over the country from the various fruit tree nurseries, will give abundant suggestions as to choice of varieties.

Another hint may be suggested. As trees, living fifty to a hundred years, cannot be subjected to frequent rotation, like annual vegetable crops, their roots will, in time, assuredly exhaust the soil in which they stand, of the specific food which they so largely draw from it. In land long cultivated, this must be supplied to the young orchards, and replaced for the support of the old ones. Wood ashes, lime, bone dust, phosphates generally, decayed wood, and a *moderate* amount of barn manure, will supply these deficiencies; and they should be supplied in sufficient quantities to keep the soil active in their distribution to the roots. Spent tan bark, sawdust, and wood shavings, (all these may come under the head of "chip manure,") when decomposed, aid largely in giving their decayed *humus* to the roots. We have seen old, decaying orchards, largely benefited and made productive by their application; and without them, where large crops of fruit are annually gathered, orchards will in time

become as surely unproductive as by the exhaustion of the soil in common farm crops, without a constant restoration of its fertility. This course of treatment refers to *all* fruits alike.

MAKING CIDER.

In connection with the cultivation of the apple, follows the manufacture of this important article, which, more or less, in some shape, enters into the consumption of every thrifty and well conditioned farm household where the fruit is grown. It has been a beverage, in apple countries, from time immemorial, and considered, when used in moderation, as palatable, healthful, and invigorating to the system. However it is used, whether as a beverage, or for vinegar, the article should be a good one.

A good cider apple should be rather astringent in its properties of flesh and juice, not what we would select as the best edible varieties, but fruit of the native or ungrafted kinds, as they grow in the nurseries; natural fruit, as it is called. Yet, even the best table and cooking varieties will make good cider.

October, and November, according to the climate, when the warm season has passed, and the lighter autumn frosts have commenced, and the fruit is in all its ruddy perfection of ripeness, is the proper time to produce the best article. The earlier varieties will, in their season, make a palatable cider, but it is lighter in its *must*, and its *keeping* qualities are of short duration. Therefore, a fruit that has enjoyed a full season's growth, and matured its rich qualities in perfection, should be sought for the purpose. Nor is it necessary that the fruit should all be of one variety; sweet, sub-acid, sour, even acrid fruits, mixed with the sweeter ones, all combine in harmonious proportion; the only requirement necessary, that they be, alike thoroughly ripe.

The fruit should be carefully gathered—shaken from the tree is all that is necessary—kept clean of leaves, shriveled windfalls, and rotten ones, and carefully housed in moderate sized heaps until the fruit is ready for working.

Grinding.—There are various ways of doing this. The modern way of *rasping* the fruit into a pulp, by rapidly revolving

cylinders filled with sharp teeth, or graters, has not been an improvement over the older, and perhaps more tedious methods of *crushing*, and the immediate pressing of the pomace, after being so rapidly ground, is an injury to its good and lasting qualities. There has not been, and we fear, cannot be any improvement over the old *crushing* process under a huge revolving stone of four or five feet in diameter, and eight or ten inches in thick ness, following in a circular *tight* trough, with flaring sides a foot or more high, like the old-fashioned bark-mill; or the upright, circular grooved blocks of wood mashing into each other, and propelled by horse power. A corrugated iron hopper, with core revolving perpendicularly within it, of a good kind, is now used. Under either of the old processes, or any other mode of grinding, when reduced to a fine pulp, (and if even the seeds are mashed, they will be no detriment,) the pomace should immediately be stored in a large shallow vat, and remain from twelve to twenty-four hours, depending on the temperature of the weather, as it may be warm or cool. If the weather be warm, it need not remain longer than the shorter; if cool, it may remain the longer time, or intermediate between them. During this time, the pomace should be well turned every five or six hours with a *wooden* scoop shovel, that it may imbibe the oxygen of the atmosphere, which sweetens, enriches, and gives it deep color. But fermentation should not be suffered in the pomace; let that be for the cider itself. When ground in the grooved blocks, the pomace falls into a large tight vat or tub, where the same delay and turning is necessary. If ground by the stone in the trough, shovelling out of the latter into the vat may be necessary, unless the trough can be placed at a higher elevation, with a movable trap door in one part of the bottom, through which the pomace may be emptied.

Pressing.—For cleanliness, as well as for convenience, and clearness of the cider, a wooden-slatted crib is better for laying up pomace in the cheese, than the old mode of building it with straw alone. The crib may be of a size necessary for the extent of work which may be required for the cider making season,—

say four to six feet square, inside. The manner of making it is this: The pieces composing the crib, should be *hard* wood scantling, three to four inches square, laid horizontally, and keyed together at the ends, or corners of the crib. The two lower scantlings should be an inch above the floor, and the others laid upon them alternately, cob-house fashion, with a slot and key in each end to keep them in place, as they are laid up, and the cheese progresses in height.

How to lay the Cheese.—First, put a good layer of clean straw on the floor inside the first set of crib work, so that, when pressed, it will not exceed half an inch in thickness; then put in an even layer of pomace four inches thick; then set up short pieces of lath, vertically, inside, with spaces an inch apart, to let the cider through as it is pressed. Other short pieces of the lath may be put in as the cheese progresses in height to the place where the pomace is thrown upon the cheese, so as not to be in the way. After the first layer of pomace, put on another one of straw, then pomace, then straw and pomace alternately until the crib is filled, which, when done, should not be over four feet high. Then lay on a covering of planks to receive the pressing blocks ready for the screw. No water should be used to wet the straw as it is laid up, for there is enough of that already in the juice. Loose planks should be laid outside the crib, on which the workmen may stand, to keep the running cider clean. The cider will run considerably of itself, as the cheese is laid before pressure. We should have said, when laying the floor of the press, that the front of it should be an inch or two lower than the rear, the planks composing the floor should butt towards the tub which receives the liquid, so that it may run down inside of the crib, instead of across them. A groove, two to three inches wide, according to the area of the floor, and an inch deep in the planks, close outside the crib, should be made to receive and conduct rapidly the liquid as it is pressed. The tub, or vat, receiving the cider, should be large enough to hold the entire pressing, that it may be well mixed, and of one quality, the first runnings being the richest; or, if the receiving tub be smaller, several barrels

may be provided and alternately poured in to keep the quality of each equal.

As the cheese becomes compactly pressed, room will be left on the top to receive fresh pomace, which may be added and laid up successively, and pressed in the same manner as the first. If the screw, or screws, and the power exerted upon them be of sufficient strength, the cheese, as is the manner with some cider makers, need not be cut for pressing over, and even then, only to make *water* cider, which is but a poor substitute for the real article. Still, some people like, and use it. If the cheese be cut, it will be necessary to take the crib apart, but it need not be replaced for pressing. When the liquid is put into barrels, a large wooden tunnel should be provided, holding two or three buckets full, tapering towards the bottom, with a discharge large enough in diameter to fill the bung of the barrel. At the bottom should be a course or two of lath, and then clean straw, through which the cider can pass without carrying its sediment. The straw should be thrown out, and replaced with fresh, as often as it gets filled. After the barrels are full, they should be tightly bunged, rolled into the cellar, and laid up on blocks, or skids, with the bungs up, for further operations. The pomace, at the press, may be fed to the cattle in moderate quantities, or go onto the manure heaps.

Fermentation.—The bungs should now be taken out, and every barrel filled to the vent with pure apple juice—not water—that the fermentation, which will soon commence, may have full play, and the impure matter, as pomace remains, and any other extraneous matter may pass off freely. This requires daily looking after, to keep the barrel full to the bung-hole, and scrape off the feculent and frothy matter with which it is charged. When this is thoroughly done, and no further effervescence arises, the bungs may again be driven tight, for keeping.

The Casks.—These should be clean and sweet. If new ones are provided, they should be of sound oak staves. If second-hand ones are used, whisky or other spirit casks are the best,

provided they be clear of *must* or other impurities. If not, they should be thoroughly cleansed with lime or wood ashes and water, and afterwards thoroughly fumigated with matches of roll brimstone dropped into the bung, after which they can be thoroughly rinsed with hot water, and drained dry. Before the cider is put into them, a small pine plug should be inserted in the outer head, two inches above the lower chime, for draining off and racking. No extraneous matter should be added after the cider has thoroughly worked. A thousand nostrums have been invented and published for preserving and improving the flavor of cider. They are sheer nonsense; make the cider as we have directed, and it will take care of itself.

The First Racking.—This has now to be done as soon after the "working" has thoroughly subsided as may be. To do this, first provide one clean empty barrel to receive the contents of the first barrel drawn off. Into this clean barrel put three gallons of the new cider drawn from the first one tapped; then take a strip of clean cotton cloth, an inch and a half wide and ten inches long, dip in melted roll brimstone, six inches of it, set it on fire, put it into the bung-hole of the cask, (the new one,) and bung it tight, letting the clean end of the lighted strip or match be in the bung, so as to hold it tight, suspended in the cask. The burning match will soon exhaust the oxygen in the barrel; then skake the barrel violently, that the cider in it may become thoroughly incorporated with the brimstone; then take out the bung and fill the barrel from the cask already tapped, avoiding the lees, if there be any. When done, replace the bung in the barrel newly racked, drive it *home*, and lay up the cask in the place of the empty one, or elsewhere. Thus proceed successively with each cask till completed. If a portion of the cider is needed for winter use, a barrel may be tapped and drawn as required.

The second and final racking may be done late in February or March, in the same manner as the first, but the brimstone, or *stumming*, may not be necessary, unless it is found that the barrels have been disturbed, or from some unknown cause the flavor

of some of them has changed, or deteriorated. It will then keep sound and good for spring and summer use, or may be bottled at leisure, being careful at this time to draw every cask clean, except the lees, if there still be any at the bottom. In bottling, let the bottles be perfectly clean, and the corks driven tight, and well secured by twine or wire. We have drank the best of cider several years old, cured in this process.

Avoid, as we before said, those wretched compounds recommended by the quacks. Pure and good cider is the pure juice of the apple, *and nothing else.* In recommending the old-fashioned cider mill, we may be accused by modern inventors of non-progression. No matter. It is impossible that the small, newly invented rasping machines, with their little tubs for receiving the pomace, to be squeezed out as soon as ground, can make good, long-keeping cider. At any rate, we have not yet seen it.

VINEGAR.

The best article is made from *pure* cider, as every manufacturer advertises his wares of the kind as "pure cider vinegar," although it is often made of various other compounds. Wine will make excellent vinegar, of course—as good as cider—but that is too expensive. Beer, adulterated whisky, and various other ingredients are used, but cider vinegar is altogether the best. In order to make it, it is only necessary to let the acid fermentation take place in a warm situation, with the bung open, and a gauze over it to keep out the flies, and a little "mother" added from a cask already made and in use. Some orchardists turn their whole apple produce into vinegar, as the least troublesome and most profitable use they can make of it. When the cider becomes really good vinegar, it should be tightly bunged, and kept till sold or used.

THE PEAR.

The pear is the most valuable, and one of the most luscious and wholesome market fruits, though not comparable to the apple for variety and general use. In a good soil, and under proper

cultivation, it is both vigorous and hardy. It is budded and grafted like the apple, and requires the same treatment; it is as easy of propagation, attains a greater size and age, and although longer arriving to maturity, it is a more abundant bearer. Its favorite soil is a clay loam. It needs little pruning, as it usually throws out an upright, graceful head, free from excessive bushiness. The trees may be planted twenty-five or thirty feet apart, an abundance of sun being requisite to full bearing, and the perfection of the fruit.

Diseases.—The pear is seldom subject to more than one formidable disease, the fire blight, and to this some localities are more subject than others. The disease manifests itself generally in midsummer, in the sudden withering of the leaves on one or more branches. The only effectual remedy is to cut off and burn the diseased limb immediately on its discovery. The causes are imperfectly known, but it has been variously ascribed to the presence of minute insects, to the abundant flow of sap, and to the severity of the winter, yet with an entire uncertainty of any truth in the supposition.

Collecting and preserving the fruit.—The pears intended for market or for long keeping, should be hand-picked and laid in a cool place; and when perfectly dry, put up in casks like apples. Winter pears should be packed for preservation like winter apples.

The varieties to be selected depends entirely on the object of their cultivation. For market, the best and most popular kinds only should be chosen, and for family use, an equally good selection should be made of those running throughout the entire season.

We name in their order of ripening, a dozen choice kinds, the cultivation of which has thus far been thoroughly successful, and the qualities universally approved. The most of these are pears of American origin, which are to be preferred as promising more durability, hardiness, and perfect adaptation to our climate and soils. Among these may be named for

Summer and early Autumn.—Bloodgood, Osband's Summer, Dearborn's Seedling, Bartlett.

Autumn.—Beurre Diel, Buffum, Sheldon, Duchess D'Angouleme, Seckel, Louise-bonne-de-Jersey.

Winter.—Beurre D'Aremberg, Winter Nelis.

There are, however, various other kinds, perhaps equally good, according to the locality on which they may be planted. Indeed, the varieties of *good* pears are very numerous, and any one who intends to make pears a specialty in cultivation, should possess himself of a competent authority, and study and practice its teachings closely for success.

In view of the ravaging effects of the blight, we can hardly recommend an extensive cultivation of the pear as a certain and permanent crop. Still, as a variety of choice, and delicious fruit, every farmer, where his soil, climate, and locality are favorable, should plant a few approved varieties.

The quince stock has been largely used of late years to grow *dwarf* pear trees, by budding the pear on its root at the surface of the ground. This method induces an earlier bearing by some years than the pear on its own stock. But their growth, usually, is not long lived, the quince being a different, and close grained wood, with more or less incompatibility to connect with the more vigorous character of the pear. Yet the mode has been attended at times with considerable success, and at others with disastrous failures. We cannot commend dwarfing the pear on the quince beyond a limited extent.

THE QUINCE.

This is also a valuable market fruit. It makes a rich, highly flavored sweetmeat, and to this use it is entirely limited. The tree is easily raised by suckers and the cuttings, and should be planted fifteen feet apart, in a rich, warm, heavy soil, (a clayey loam is the best,) rather moist, and in a sunny exposure where it will be well sheltered from severe and cold winds. The wash of a barn-yard is its best manure, and it repays equally with the

apple, for good cultivation. The fruit is large, sometimes weighing a pound, of a rich yellow color, and generally free from worms and other imperfections. Its chief enemy is the *borer*, which in many instances has been most destructive. It ripens in October and November. The orange quince is the best variety for common cultivation. The tree requires but little pruning. The trunk may be entire for two or three feet, or branch from the ground by two or more stems. The top should be kept open to admit the sun and air, and the trunk freed from suckers. So treated, it will live long and produce abundantly.

THE CHERRY.

Aside from the value of its fruit, the cherry is an ornamental shade tree, hardy and vigorous in its growth, and easy of propagation. It should be planted like the apple. For culinary purposes, the common red cherry is perhaps the best. This may stand sixteen to twenty feet apart, according to soil and situation. The large Mazard or the English cherry requires more room, and if on a deep, warm, sandy loam, its favorite soil, it should be planted two rods apart, as it grows to a large size. It will flourish luxuriantly on a clay loam, if well drained, or on an open gravel, provided the soil be rich and deep; but on these it demands more careful cultivation. It seldom requires much pruning. Care must be used with this as with all other fruit trees, to give it an open head and to keep the limbs from crossing and chafing each other. The varieties most in use are the Common Red Kentish or Pie Cherry, with which every one is familiar, the English Mayduke, Black Tartarian, Bigarreau, (Graffion or Yellow Spanish,) the large Red Bigarreau, Elton, Elkhorn, (latest and best of all, we think,) and several other approved varieties, which will readily be found on consulting the fruit books and nurserymen. These will form a succession of six weeks in ripening, and embrace the entire cherry season. The cherry is remarkably free from disease, and it usually requires but ordinary care in its cultivation.

THE PLUM.

In its superior varieties this is a delicious fruit, and is generally easily cultivated. It prefers a strong clay loam, but does well in any ordinary ground except a light sand. It should be planted like the apple, though on a smaller scale, as it has a smaller and less vigorous growth. The proper distance is sixteen to twenty feet apart. There are two formidable impediments in the cultivation of the plum. One is the black knot, or woody fungus, which bursts the bark on the body, branches and twigs of the tree. This is followed by a large swelling or excrescence, and if suffered to remain, will soon destroy its productiveness. The best and surest remedy is to cut off the branch at once and burn it. *The Curculio* commits its depredations on the young fruit soon after the blossoms disappear. These are frequently so destructive as to kill the fruit of an entire orchard. Several methods of destroying them have been suggested, of which the most simple and effectual is, to plant the trees in such places as will admit the swine and poultry to feed upon the fallen fruit and insects. Salt sprinkled around the tree in the spring is said to destroy them. The smoke of rotten wood, leaves and rubbish which has been burned under the trees when in blossom has sometimes proved beneficial. Paving the earth under the limbs has been said to prevent the burrowing of the insects. Some other remedies are recommended, such as spreading white cotton sheets on the ground underneath, and suddenly jarring the body of the tree that the insects may fall; and then gathering the cloths together and immersing them in hot water to kill them. This must be a daily work, done early in the morning when the insects are stiff from the cool dews. It is of course, a work of labor, but is said to be effectual when vigilantly practiced. The pig and chicken remedy we consider much cheaper, and usually effectual, and for such purpose these scavengers should, if possible, be confined within the boundaries of the plum orchard.

VARIETIES.—The common blue or horse plum is cultivated in numerous sub-varieties. Some of these are very good, others

utterly worthless. Good plums are as easily raised as poor ones. Young trees bearing an indifferent fruit, can be headed down and grafted as readily as apples, but this requires to be done a month earlier in the spring and before the buds begin to swell. The best kinds are the Lombard, the Yellow, Green, Autumn, Bleecker's, Imperial, Prince's Yellow, Frost, Purple, and the Red Gages, Coe's Golden Drop, the Jefferson, the Orange, the Washington, the Columbia, Smith's Orleans, and the Red and White Magnum Bonums.

These last two varieties are more liable to the attacks of the circulio than many others. But their vigorous growth, great productiveness when not attacked, and excellent quality for preserving, render them desirable fruits. *For drying*, the German prune is perhaps the best, although several of the plums above named answer an excellent purpose. We have enumerated a larger variety of plums, from the difficulty in our northern climates generally of cultivating the peach, which ripens nearly at the same time, and although not so delicious a fruit, the plum is a valuable substitute for it. It is a more durable tree though liable to several diseases, and its cultivation is comparatively easy.

THE PEACH.

This fruit on virgin soils and in the early settlement of our country, was one of the easiest of propagation and most abundant in its bearing, but it is now the most uncertain in its maturity and the shortest lived of all. So liable is it to casualties, as to have become almost entirely discarded in large sections of the United States, where it once flourished in the highest perfection. It is now generally reared on an extensive scale for market, by those who make it an exclusive business.

Its favorite soil is a light, warm, sandy or gravelly loam, in a sunny exposure, protected from severe bleak winds. Thus situated, and in favorable latitudes, it often flourishes in luxuriance, and produces the most luscious fruit. In portions of Western New York, and on the southern borders of Lake Erie, and the

east shore of Lake Michigan, south of latitude 43°, the peach grows more vigorously, and lives longer than in any other sections of the United States, frequently lasting twenty or thirty years, and bearing constantly and in abundance. Peaches are produced in immense quantities in the States of New Jersey and Delaware, on the light soils near the Atlantic coast, for the large city markets, and in those States the crop of a single proprietor often amounts to $5,000, and sometimes exceeds $20,000 annually. None but the choicest kinds are cultivated, and these are inoculated into the seedling when a year old. They are transplanted at two and three, and are worn out, cut down and burned at the age of from six to twelve years. The proper distance at which they should be planted is sixteen to twenty feet apart, according to situation, soil and exposure. Constant cultivation of the ground, without cropping, is necessary for their best growth and bearing.

Diseases.—It is liable to many diseases and to the depredations of numerous enemies. *The yellows* is its most fatal disease, and this can only be checked by the immediate removal of the diseased tree from the orchard. *Of the insects*, the grub or peach worm is the most destructive. It punctures the bark, and lays its egg beneath it at the surface of the earth, and when discovered it should be killed with a penknife or pointed wire. A good preventive is to form a cone of earth a foot high around the trunk about the first of June; or if made of leached ashes it would be better. Remove this heap in October, and the bark will harden below the reach of the fly the following year.

Varieties.—The best kinds in succession from early to late, are Hale's Early, Red and Yellow Rareripes, Crawford's Early, and Late Malacatune, Early York, Early Tillotson, George the Fourth, Morris Red, and White Rareripes, and Royal George. These succeed each other from August to October.

The Apricot and Nectarine.—These are of tho peach family, but generally inferior as a fruit and much more difficult of cultivation, being more liable to casualties and insects. They

require the same kind of soil and cultivation as the peach, with a warm exposure. As they are propagated solely as an article of luxury, and are not wanted for general use, we omit further notice of them.

THE GRAPE.

The details for the proper rearing of this fruit demand a volume, but we can only refer to some prominent points in its cultivation. It grows wild in abundance, and of tolerable quality in many parts of the United States, climbing over trees, rocks and fences in great luxuriance. We have seen in the Eastern States a dozen native varieties of white, black and purple, of different sizes, shapes and flavor, growing within the space of a single furlong. The more choice and delicate European, or house grapes, must have protection in winter and glass heat in summer, and are therefore better suited to large towns, or to a well arranged conservatory. The usually cultivated *field* grapes of Europe, as a rule, do not succeed in America. They have for many years been thoroughly tried, and thrown out as failures. They *mildew* almost without exception.

The grape has, within the last twenty years, become so widely propagated in the Middle and Northern States, from the Atlantic seaboard to the Missouri river, below latitude 43°, and in some particular localities above, as to have become a distinct item of culture, and management. Large vineyards have been planted, and are in successful cultivation; thousands of tons of the fruit are raised, shipped to our large market cities and towns and sold, so that they have become almost as familiar as apples, and millions of gallons of excellent wine from the vineyards are made, sold, and consumed by our population. So absorbed have the grape propagators become in their culture that several valuable books and treatises have been written and published on vineyards, grapes, and wine making, and scores of new and valuable native varieties produced, suited to our different climates, positions, and soils. And so easy and simple has their cultivation become, that

every farmer and cottager, in a favorable locality, may sit under his own vine and enjoy its fruit in abundance.

California has long been a paradise of the grape, containing extensive vineyards, with great yields of wine. It will probably become one of the most productive wine countries in the world.

Soil.—Any *good* soil, *well drained*, artificially, if not so in its own formation, and in a fair exposure, from a stiff clay, to almost a drifting sand, will produce the grape of approved varieties (when they are such as will ripen between its spring and autumn frosts,) in perfection. In culture they are not difficult, needing only to be kept free from weeds and other herbage, properly trained on stakes, or trellises, and well pruned.

Varieties.—These are getting to be so extensive—new kinds of good quality being frequently originated and brought to notice—that it is impossible to enumerate the best for general use, as many of the varieties seem more or less partial to special localities, and the purposes, either for the table, or wine, for which they are needed. As early fruits, the Hartford Prolific, Concord, Delaware, Israella; for the medium season, the Diana, Clinton, Iona, and some others; for the later season, the Isabella, Catawba and others, are already well established, thoroughly tried, and of unimpeachable excellence, as both table and wine fruits. In the selection of these, or still other varieties for either use, the cultivator must judge from his own stand-point; yet the various kinds are now so generally cultivated by the nurserymen that the planter need be at no loss in his selections. We trust that the time is not far distant when the lighter wines can be made by the farmer and cottager for their own uses as readily and freely as cider is now made by the orchardist, and the fruit kept for winter use, as easily as apples. Twelve pounds of grapes will make a gallon of wine, and with little more labor or expense than to produce good cider from apples, and in much less time from planting.

Every one intending to cultivate the grape to any extent, or even a few vines for family use, will be well repaid in getting a treatise on their culture, and thoroughly studying it. They may be obtained at almost any of the bookstores.

THE CURRANT

Is the first in importance of the small garden fruits. It is a delicious and wholesome tart on the table in its ripe and raw condition, when sprinkled with sugar, and valuable in cookery, for pies and preserves. It grows with the greatest certainty and luxuriance, either from the suckers, or cuttings. The soil should be deep, rich, and well worked, the bushes set full four feet apart, that the air may pass freely through them, and the wood properly thinned to promote good bearing. The large *Red* Dutch, Cherry, and Versellaise, are the best of the tart or red varieties, and the large *White* Dutch or Grape, the best of the sweet or whites. The English, and Naples, are the best black varieties; not much esteemed for the table, but excellent for jellies, and most grateful in sickness, and for invalids. There are some other varieties in cultivation, but those named comprise all the good qualities which are necessary in the fruit.

Currants should not be planted under fences, and in out of the way places where they are subject to the annoyance of noxious weeds and vermin, as is too often the case, but stand out in the clear, open sunshine where they can receive cultivation. They are as much better for it as any other fruits. Of late years they have been attacked with a most destructive slug or worm, which destroys the leaves just before the fruit ripens, thus cutting off the crop, and shortly killing the shrubs. We trust that this new insect may prove only migratory and pass away. The application of powdered hellebore on both sides of the leaves when the dew is on, or moistened by rains, has in many instances proved effective against their ravages. Wood, and coal ashes, and slaked lime freely spread over them or strewn under the shoots and around the roots, have also answered a good purpose.

THE GOOSEBERRY.

This has been considerably cultivated in our gardens, but it is an indifferent fruit. The English varieties, which produce the

largest fruits, mildew badly in our American climate by reason of the extreme summer heats, and our native varieties, although less liable to mildew, have little merit, being small in size, and lacking flavor; yet many people are partial to them.

As a tart for cooking, the gooseberry is far inferior to the *Rhubarb* or *Pie-plant*, which is grown with little trouble or expense in a *rich* soil, and is in season from May until October. The best of the many varieties which we have cultivated, is the *Linnæus*, being both early and late, of large size, and delicate flavor.

THE RASPBERRY,

A most wholesome, grateful, and palatable fruit to the taste, and growing, in its native black and red varieties, profusely in many parts of the country, in the edges of woods, along fences, stone walls, and other waste places, is altogether too luscious and valuable to be abandoned to such precarious gatherings. It is worthy a place and cultivation in the garden, or special plantations, either for household supply, or the market. Although many foreign kinds have been introduced here, the new American varieties have proved, in a general way, the best.

The American *Black Caps*, of which there are now several varieties, all derived from native *wildings*, are, perhaps, of all others the most successful and hardy. Among these are the Doolittle, Miami, Thornless, and some others. They are propagated from the ends or tops of the current season's growth, bent to the ground and slightly covered, where they strike root, and make new plants for setting the next spring.

Among the *suckering* varieties of red color, the Franconia, said to be foreign, is an excellent, hardy, and prolific kind. There are other native red, purple and yellow kinds, some of them not always hardy against our winters, without bending down and covering with earth, an expensive process. Yet there are other good and hardy ones, easy to be obtained, as the Philadelphia, Clarke, etc., of excellent bearing and flavor. These all grow

from the suckers, and are easily propagated. The Orange (Brinckle's) is perhaps the highest flavored of all, but requires a rich soil and winter covering to be successful.

They should be planted four to six feet apart, in stools, and cut back to three or four feet high in the fall of the year, the past bearing wood cut out, and but four or five canes left for the next bearing season. The tops of these should be brought together the next spring and tied with twine, when they will stand without further support. They should be lightly plowed, or cultivated between the rows, and kept free of weeds. In this way they will yield bountiful crops and well pay for cultivation. If intended for market, the market should be near, as being a *hollow* fruit, they cannot bear distant transportation.

THE BLACKBERRY.

This, also, is a wild native fruit, growing like the raspberry, in waste places, and much better and more desirable when in garden cultivation. There are several varieties, the best of them of recent introduction. The New Rochelle, or Lawton, has maintained considerable celebrity, but is now somewhat superceded by newer and better kinds. It grows rank and high, is a prodigious bearer of large berries, very tart in flavor, good for canning, but requires much sugar in cooking, or for the table. The wood lacks in hardiness, in some localities, being apt to winter kill, when exposed, and difficult to protect. The Wilson is better in flavor and earlier in ripening. So also is the Dorchester, and particularly the Kittatinney, these several varieties being hardy, and continuing, through them all, five or six weeks in bearing.

These varieties all sucker from the root, come up new in sprouts the first year, bearing the next, and dying, to be cut out and give place to the younger canes. They are an excellent fruit for family use, and profitable for market, bearing longer transportation than the raspberry, being a *solid* fruit. Like the raspberry, they dry and cook well for winter use.

THE STRAWBERRY,

Is perhaps the choicest, and most highly prized, as a luxury, of all the small garden fruits. It is wholesome in its use, exquisite to the taste, with the addition of sugar, good in every condition, for the table in its raw state, and cooking into every choice sort of preservation that the cunning housewife can invent.

Thirty or forty years ago it was only a fruit of the fields and meadows, delicious in taste, small in size, scarce to be obtained, and highly prized. Now it is as common in our gardens as any other fruit, and in numerous variety, sold extensively in our markets, and used by almost everybody. They are all derived from foreign and native seedlings. Kinds a few years ago highly prized, have since been thrown out as unworthy of cultivation, and now supplanted by new and choicer ones.

We might name perhaps twenty varieties now highly approved in various localities, but subject to be changed at any time for newer, and possibly better, so rapidly do they come into cultivation. Were we to name them, before our words are five years old, they might be out of date for something more *fashionable*, although hardly better.

They thrive in any good garden, or even field soil, where other dry land crops grow, but need good, and deep, and clean cultivation. They should be planted in separate hills, or rows, two to three feet apart, and a foot apart in the rows, the runners cut off till past fruiting, when they may be suffered to run for new plants which are to take the place of the older ones after two years bearing.

When the new plants are fit for bearing, the old ones should be spaded or plowed under, that the younger ones may bear in their turn, to undergo the same process afterwards. There are different ways of cultivation, some preferring to keep them apart in hills, which perhaps give the largest fruits, while others let them run together, and when past bearing, turn under the entire beds and resort to new plantations. In such cases the new

beds should be planted the previous year, to produce continuous crops.

We do not name the varieties in common cultivation, for reasons before stated, but any one proposing to cultivate the fruit, cannot be at a loss, on consulting the hundreds of advertisements in the agricultural and garden periodicals, and the strawberry growers in his immediate vicinity, what to select for his own immediate use.

THE BARBERRY.

This is a wild American fruit, very common in the New England States, where it grows luxuriantly in the poorest sandy, gravelly, and stony soils. It attains a growth of eight or ten feet high from a compact fibrous root, does not sucker, and is readily raised from the seed. The wood has a beautiful, small, light green, oval leaf, borne on upright, and when in fruit, somewhat bending and graceful shoots, giving them a finely ornamental appearance. The fruit is grown from a light yellow blossom, and hangs pendulous in numerous berries, on a stem of three or four inches in length, long oval in shape, and a brilliant scarlet in color. It ripens about the time of the early frosts and will remain some weeks, the succeeding frosts, if not too severe, adding to their flavor and ripeness.

The fruit is tart, and piquant in flavor, making, with sugar, a delicious jelly, or jam, most grateful to the palate in health, as well as in sickness where fever affects the system. It makes also a most palatable summer drink, with water, equal to shrub, or lemonade.

The barberry makes a fine, ornamental hedge for a garden, or lawn, sufficiently strong and compact, when grown, and with its small sharp spikes will turn all ordinary animals. It has a rapid growth, and starts out strongly from the root without underground running suckers. It also forms a graceful clump of shrubbery, when planted in single roots, for the lawn, and with its bright scarlet fruit, there are few, even of the more valued exotic shrubs that excel it.

It is easily raised from the seed, in nursery rows, on almost any land, not wet. We decidedly commend the barberry for limited cultivation.

THE AMERICAN CRANBERRY, (OXYCOCUS MACROCARPUS,)

Yields one of the most delicious of our tart esculents. It is found in great abundance in many low, swampy grounds in our Northern and Western States; and although it has been gathered from its native haunts from the earliest settlement of the country, yet it is only within a few years that it has become an object of cultivation. Experience, after many years' trial, has developed the certain means of attaining the greatest success, and enough is already known, to assume that they are a profitable object of attention to the farmer.

SOIL AND CULTIVATION.—They are generally planted on low, moist meadows which are prepared by thoroughly taking out all aquatic or other shrubs or trees, filling in with gravel where needing it, and plowing and harrowing. They are then set in drills by slips and roots, usually in the spring, but sometimes in autumn, about twenty inches apart and at distances of about three inches. They require to have the weeds kept out and the ground stirred with a light cultivator or hoe, and they will soon overrun and occupy the whole ground. An occasional top dressing of swamp muck is beneficial. Cultivators in Massachusetts, have in this way, produced at the rate of three hundred bushels per acre, which were worth in the market from two to four dollars per bushel.

This fruit is now cultivated largely in the marshes of New Jersey, wide tracts of which have been reclaimed and devoted to its culture. It is a sure and progressive crop in our country.

The cranberry is sometimes killed by late or early frosts, and it has been suggested, that these might be avoided by having the fields so arranged when they may be expected, as to be slightly covered with water. The berries are gathered when sufficiently ripe, by raking them from the bushes. They are

cleaned from the stems, leaves, and imperfect fruit, by washing and rolling them over smooth boards set on an inclined plane, in the same manner as imperfect shot are assorted. After this they are put into tight casks and filled with water. If stored in a cool place, the water changed at proper intervals, and the imperfect berries occasionally thrown out, they will keep till the following summer. They will frequently bring $20 per barrel in European markets. The raking is beneficial rather than otherwise to the plants, for though some of the plants are pulled out and otherwise broken, their places are more than supplied by the subsequent growth.

CHAPTER XI.

MISCELLANEOUS OBJECTS OF CULTIVATION.

BROOM CORN, (SORGHUM SACCHARATUM.)

So far as we are acquainted with its history, this is a product peculiar to America. In its early growth and general appearance it resembles Indian corn. It stands perfectly upright at a height of eight feet or more, with a stalk of nearly uniform size throughout, from which an occasional leaf appears; and at the top a long, compact bunch of slender, graceful stems is thrown out, familiarly termed the *brush*, which sustains the seed. An approved dwarf variety has lately been introduced.

Soil.—The best soil for raising broom corn, is similar to that required for Indian corn or maize. It should be rich, warm, loamy land, not liable to early or late frosts. Spring frosts injure broom corn more than maize, as the roots do not strike so deep, nor has it the power of recovering from the effects of frost equal to the latter. The best crops are usually raised on a green sward, turned over as late as possible in the fall, so as to kill the worms. Clay lands are not suitable for it. A river bottom is best of all.

Manure.—Hog or sheep manure is best, and rotten better than unfermented. If the land is in good condition, three cords, or eight loads to the acre is sufficient. This is usually placed in hills, and twelve to fifteen bushels of ashes per acre may be added with great advantage. Plaster is beneficial at the rate of two to four bushels per acre. The addition of slacked lime helps the ground, affords food to the crop, and is destructive to

worms. Poudrette, at the rate of a gill or so to each hill at planting, or guano at the rate of a tablespoonful per hill, if the African, or two-thirds the quantity if Peruvian, mixed into a compost with ten times its quantity of good soil, is an excellent application, especially if the land is not in very good heart. To repeat either of the above around the stalks on each hill after the last hoeing, will add materially to the crop.

PLANTING.—It should be planted in hills three feet apart, in rows three to four feet distant. If the seed is good, ten or twelve seeds to a hill are enough; if not, put in sufficient to insure five or six thrifty plants, which are all that require to be left for each hill. Time of planting must depend on climate and season. The first of May is time for planting in latitude 40°, and later as the season occurs, up to 43°; but as early as possible, yet late enough to escape spring frost is best. The ground should be thoroughly harrowed and pulverized before planting. Thick planting gives the finest, toughest brush. Seed should be buried one to one and a half inches deep.

AFTER CULTURE.—As soon as the plants are visible, run a cultivator between the rows, and follow with a hand hoe. Many neglect this till the weeds get a start, which is highly prejudicial to the crop. The cultivator or a light plow should be used afterwards, followed with a hoe, and may be repeated four or five times with advantage. Breaking the tops should be done before fully ripe, or when the seed is a little past the milk; or if frost appears, then immediately after it. This is done by bending over the tops of the rows towards each other, for the convenience of cutting afterwards. They should be broken some thirteen inches below the brush, and allowed to hang till fully ripe, when it may be cut and carried under cover, and spread till thoroughly dried. The stalks remaining on the ground may be cut close or pulled up and buried in the furrows for manure or burnt, and thus be restored to the earth to enrich it; or they may be carried to the barn-yard to mix in a compost, or with the droppings of the cattle.

Cleaning the Brush.—This is done by hand, by passing it through a kind of hetchel, made by setting upright knives near enough together, or it may be cleaned by a long toothed currycomb. By the first method none of the little branches are broken, and the brush makes a finer, better broom. Horse power machines are frequently used for cleaning the seed, which they do with great rapidity. The average yield is about five hundred pounds of brush per acre. It varies according to season and soil, from three hundred to one thousand pounds. The price also varies materially, depending on the extent of the crop and demand. A good crop of seed is obtained in the Connecticut valley about two years out of five. When well matured, the seed will average three to five pounds, for every pound of the brush. A single acre has produced one hundred bushels seed, though twenty-five to fifty is a more common yield. It weighs about forty pounds per bushel.

The uses of broom corn are limited to the manufacture of brooms from the brush, and the consumption of the seed when ground and mixed with other grain, in feeding to fattening or working cattle, sheep and swine, and occasionally to horses. Brooms manufactured from it, have superceded every other kind for general use in the United States, and within a few years they have become an article of extensive export to England and other countries. The brush, and wood for the handles, are imported separately to avoid high duties, and are there put together, and form a profitable branch of agricultural commerce to those hitherto engaged in the traffic. The cultivation of broom corn has, till quite recently, been almost exclusively confined to the North-eastern States, but it is now largely raised in the Western States. Their fresh, rich soil, however, does not in general yield so fine, tough, and desirable a brush as that grown in the older cultivated soils.

FLAX, (LINUM USITATISSIMUM.)

This is one of the oldest cultivated plants of which we have any record; and its habitat or region of naturalization, extends

from the torrid to the frigid zones. Its long, silken fibres, which come from the outer coating or bark of the stem, has been used for the manufacture of linen, from time immemorial. The absolute quantity at present grown, is probably equal to that of any preceding age; but relatively, it is falling behind the product of cotton, which is rapidly on the increase. Flax is still a profitable crop, for in addition to its use as a material for clothing, the seed is of great value for its oil, and the food it yields to cattle.

The proper soil for flax, is a good alluvial or vegetable loam, equally removed from a loose sand or tenacious clay. In a very rich soil the fibre grows too coarse, and on a hard soil, the crop will not make a profitable return. Fresh barn-yard manures are not suited to it, and they should in all cases where necessary for a proper fertility, be added to the preceding crop. A rich sod which has long lain in pasture or meadow, well plowed and rotted, is the best for it. Lime in small quantities may be given to the soil, but the Flemings, who raise flax extensively, never allow it to follow a heavy liming, till seven years intervene, as they consider it injures the fibre. A good wheat is generally a good flax soil. Salt, ashes, and gypsum, are proper manures for it; the last has the greatest effect if applied after the plant is developed and while covered with dew or moisture; all the saline manures used as a top dressing, benefit the plant and check the ravages of worms which frequently attack the young plants.

Culture.—On a finely prepared surface of fresh sod, or after corn or roots which have been well cleared, sow broadcast, from sixteen to thirty quarts per acre if wanted for seed, or two bushels if wanted for the fibre. When thin it branches very much, and every sucker or branch is terminated by a boll well loaded with seed. When thickly sown, the stem grows single and without branches, and gives a long, fine fibre. If the soil be very rich, and fibre is the object of cultivation, it may be sown at the rate of three bushels per acre. There is a great difference in seed; the heaviest is the best, and it should be of a

bright brownish cast, and oily to the touch. It should be lightly harrowed or brushed in and rolled. When three or four inches high, it may be carefully weeded by hand, and for this it is best to employ children, or if adults are put on the field, they should be barefoot, and any depression of the plants by the feet will soon be recovered by the subsequent growth, which on good soil, will be sufficiently rapid to prevent the weeds again interfering with it.

HARVESTING.—When it is designed for cambrics and the finest linen, flax is pulled when flowering; but in this country it is seldom harvested for the fibre till the seed is entirely formed, and although not ripe, most of it will mature if pulled, while the fibre is in its full strength. If required for seed, it should be left standing, till the first seeds are well ripened. It is then gathered and bound in small bundles, and when properly dried is placed under cover. If it falls before ripening, it should be pulled at once, whatever be its stage of growth, as it is the only means of saving it.

AFTER MANAGEMENT.—The usual method of preparing flax in this country, after removing the seed by drawing the heads through a comb or rake of finely set teeth, called rippling, is by dew-rotting, or spreading it thinly on a clean sward, and turning it occasionally till properly rotted, after which it is put into bundles and stored till a convenient period for cleaning it. This is a wasteful practice and gives an inferior quality of fibre. The best plan of preparing it is by water-rotting, which is done in vats or small ponds of soft water, similar to those used for hemp. This gives a strong, even, silky fibre and without waste, and worth much more either for sale or for manufacturing than the dew-rotted. Various steeps for macerating, and machines for preparing it have been used, which materially increases its marketable value. The fibre is generally got out on the *break* by hand, when the farmer is most at leisure. A crop of the fibre may be estimated at 300 to 1,000 pounds; and of seed, from fifteen to thirty bushels per acre. (See machine noticed in *Hemp-break*, page 252.)

There are no varieties worthy of particular notice, for ordinary cultivation. Great benefit is found to result from a frequent change of seed, to soils and situations differing from those where it has been raised. The seed is always valuable for the linseed oil it yields, and the residuum or oil cake stands deservedly high as a feed for all animals; and the entire seed when boiled, is among the most fattening substances which the farmer can use for animal food. Flax, like most other plants grown for seed, is an exhausting crop, but when pulled or harvested before the seed matures, it is not. The Flemings think flax ought not to be raised on the same soil oftener than once in eight years. It may be oftener repeated in this country.

HEMP, (CANNASBIS SATIVA,)

Is suited to large portions of our western soils and climate, and for many years it has been a conspicuous object of agricultural attention. We have not yet brought the supply to our full consumption of it in its various manufactured forms, as we have till recently imported several millions annually. But the increased attention and skill bestowed on its cultivation, combined with our means for its indefinite production, will doubtless, ere long, constitute us one of the largest of the hemp exporting countries.

The Soil for hemp may be similar to that for flax, but with a much wider range from a uniform standard, for it will thrive in moderately tenacious clay, if rich, drained, and well pulverized; and it will do equally well on reclaimed muck beds when properly treated. New land is not suited to it till after two or three years of cultivation. A grass sod or clover bed is best adapted to it when plowed in the fall or early in winter. This secures thorough pulverization by frost and the destruction of insects, and especially the cut-worm, which is very injurious to it. It should be re-plowed in the spring, if not already sufficiently mellow, as a fine tilth, considerable depth and great fertility are essential to its vigor.

Cultivation.—Early sowing produces the best crop, yet it should not be put in so early as to be exposed to severe frost;

and where there is a large quantity planted, convenience in harvesting requires that it should ripen at sufficient intervals. The farmer may select his time for sowing, according to his latitude, and the quantity cultivated. From the tenth of April to the tenth of June is the fullest range allowed. The choice of seed is material, as it is important to have a full set of plants on the ground; yet an excess is injurious, as a part are necessarily smothered after absorbing the strength of the soil, and they are besides in the way of the harvesting, without contributing anything to the value of the crop. Seed of the last year's growth is best, as it generally heats by being kept over, which can be avoided only by spreading thin. From four to six pecks per acre of good seed, is sufficient. The best is indicated by its weight and bright reddish color. It is usual to sow broadcast, and harrow in lightly both ways, and roll it. A smooth surface is material in facilitating the cutting. Sowing in drills, would require less seed, give an equal amount of crop, and materially expedite the planting. This should always be done before moist weather if possible, as rapid and uniform germination of the seed is thus more certainly secured. If the soil be very dry, it is better to place the seed deeper in the ground, which can be done with the cultivator. If sown in drills and well covered, it might be previously soaked so as to secure early germination in the absence of rains.

Cutting.—No after cultivation is necessary, and as soon as the blossoms turn a little yellow, and begin to drop their leaves, which usually happens from three to three and one-half months after sowing, it is time to cut the hemp; if it stands, however, a week or ten days longer than this, no other detriment will ensue except that it will not rot so evenly, and becomes more laborious to break. Cutting is now almost universally practiced in preference to pulling. Not quite so much lint is saved by the first as by the last process, but the labor is pleasanter, and all subsequent operations, such as spreading out, stacking and rotting, are made easier. The lint also is of a better color and finer fibre, and the

roots and stubble left in the ground and plowed under, tend to lighten the soil, and as they decompose, become an equivalent to a light dressing of manure. If the hemp is not above seven feet high, it can be cut with cradle scythes, similar to those used for wheat, (only larger and stronger,) at the rate of an acre per day; but if above this height, hooks must be used, full three inches wide, of a corresponding thickness, and about two and a half feet long, something in the shape of a brush scythe or sickle, attached to the end of a long and nearly straight snath, and with these half an acre is considered a good day's work.

Drying and Securing.—As fast as cut, spread the hemp on the ground where it was grown, taking care to keep the butts even, when if the weather be dry and warm, it will be cured in three days. As soon as sufficiently dried, commence binding into convenient sheaves, and if destined for water rotting, it ought to be transported to dry ground convenient to the pools, and then secured in round stacks, carefully thatched on the top to keep out the rain; but if designed for dew rotting, it should be secured in the same field where grown in large ricks. The reason why these are to be preferred is, that less of the hemp in them is exposed to the weather, and of course the more and better the lint when it comes to be rotted and broken out.

The Ricks should be thirty to forty feet long, and fifteen to twenty feet wide, the best foundation for which is large rails or logs laid down for the bottom course, six feet from each other, then lay across these, rails or poles one foot apart. As the hemp is bound in sheaves, let it be thrown into two rows, with sufficient space for a wagon to pass between. "While the process of taking up and binding is going on, a wagon and three hands, two to pitch and one to load, is engaged in hauling the hemp to the rick, and stacking it. The rick should be in a central part so as to require the hemp to be removed as short a distance as possible. Thus the process of taking up, binding, hauling, and ricking, all progress together. In this way five hands will put up a stout rick in two days and cover it. By having two

wagons and ten hands, it may be accomplished in one day. It is proper to remark, that for making the roof of the rick, it is necessary to have *long* hemp, from which the leaves should be beat off. *In this state only will hemp make a secure roof.*"—*Beatty.*

In laying down the hemp, begin with the top ends of the bundle inside, and if they do not fill up fast enough to keep the inside of the rick level, add as occasion may require, whole bundles. Give it a rounded elliptical form at each end, and as it rises it must be widened so as to make the top courses shelter the bottom ones, and after getting up about twelve feet high, then commence for the roof, by laying the bundles crosswise, within a foot of the edges of the rick, building the top up roof-shaped, of a slope at an angle of about forty-five degrees. This finished, for the covering of the roof lay up the bundles at right angles to its length, the butt ends down, and the first course resting on the rim of the rick as left all around, one foot in width. Lap the bundles in covering the roof in courses, precisely as if shingling a house. The first shingling thus finished, commence the second by reversing the bundles, placing the top ends down, and then go on lapping them as before. The third course of shingling begin with the butt ends down again, letting the first course hang at least one foot below the edge of the roof, as eaves to shed off the rain well from the body of the stack. Unbind the bundles, and lay the covering at least one foot thick with the loose hemp, lapping well shingle fashion as before, and for a weather board, let the top course come up above the peak of the roof about three feet, and be then bent over it, towards that point of the compass from which the wind blows least. If the work has been faithfully performed, the rick may be considered as finished, and weather proof, and it requires no binding with poles or anything else. The rick should be made when the weather is settled and certain, for if rain falls upon it during the process, it will materially injure the hemp. There ought always to be a sufficient number of hands in the field to gather, bind the shocks, and finish the ricking in a single day.

Time of Dew Rotting—The best time for spreading hemp for dew rotting, is in the month of December. "It then receives what is called a winter rot, and makes the lint of the hemp a light color, and its quality better than if spread out early. But where a farmer has a large crop, it is desirable to have a part of his hemp ready to take up late in December, so that he may commence breaking in January. To accomplish this object, a part of his crop may be spread about the middle of October. It would not be prudent to spread earlier, as hemp will not obtain a good rot if spread out when the weather is warm. The experienced hemp-grower is at no loss to tell when hemp is sufficiently watered. A trial of a portion of it on the break will be the best test for those who have not had much experience. When sufficiently watered, the stalks of the hemp lose that hard, *sticky* appearance or feel, which they retain till the process is completed. The lint also begins to separate from the stalk, and the fibres will show themselves somewhat like the strings of a fiddle-bow attached to the stalk at two distant points, and separate in the middle. This is a sure indication that the hemp has a good rot.

Shocking after Breaking and Rotting.—"When hemp is fit to be taken up, it should be immediately put in shocks, without binding, of suitable size. If it is dry, the shocks should be immediately tied with a hemp band, by drawing the tops as closely together as possible, in order to prevent the rain from wetting the inside. If carefully put up and tied, they will turn rain completely. Each shock should be large enough to produce from fifty to sixty pounds of lint. If the hemp should be considerably damp, when taken up, the shocks should be left untied at the tops until they have time to dry. If shocks are not well put up, they are liable to blow down by a strong wind. To guard against this, it is desirable, when commencing a shock, to tie a band around the first armful or two that may be set up, and then raise up the parcel so tied, and beat it well against the ground so as to make it stand firmly in a perpendicular direction. The balance of the shock should now be set regularly around the part as herein

directed. If hemp be carefully shocked, it will receive little or no injury till the weather becomes warm. In the meantime it should be broke out as rapidly as possible. If the operation be completed by the middle of April, no material loss will be sustained. If delayed to a later period, more or less loss of lint will be the consequence. Cool, frosty weather is much the best for hemp breaking. In that state of the weather, if the hemp is good, first rate hands on the common hemp-break, will clean two hundred pounds per day, upon an average. Two of my best hands, during the past season, for every day they broke, favorable and unfavorable, averaged one hundred and eighty-six pounds. Two others, who are young men, and not full hands, averaged one hundred and forty-four pounds. The ordinary task for hands is one hundred pounds."—*Beatty.*

Hemp-break.—The hand hemp-break is made precisely like that for flax, only much larger; the under slats on the hinder end are sixteen to eighteen inches apart; at the fore end they approach within three inches of each other. The slats in the upper jaw, are so placed as to break joints into the lower one, as it is brought down on to the hemp. It is a machine so common, however, that we deem further description unnecessary. After breaking out the hemp, it is twisted into bunches, and sent to the press house to be baled, and is then transported to market. We are happy to say that an effective hemp and flax breaking and hetcheling machine has lately been brought into use, and sold by the larger dealers in agricultural implements throughout the country.

Water Rotting.—We think the best plan for water rotting is in vats under cover, the water in which is kept at an equable temperature. The hemp thus gets a perfect rot at all seasons of the year, in seven or ten days, and when dried, is of a bright, greenish, flaxen color, and is considered by many, of a better quality, and appears as handsomely as the finest Russian, and brings as high a price in market. These vats may be easily constructed and managed, and if built in a central position, by a

company of planters on joint account, they would be but of small expense to each, and all in turn could be accommodated by them. The hemp is first broken in a machine, which is moved by steam power, previous to rotting; this lessens the bulk greatly, by ridding it of most of its woody fibre; but the process is not essential to rotting in vats, and can be dispensed with where the machines do not exist. If it be rotted in spring or river water, artificial pools or vats must be formed for this purpose, and should not be over three feet deep, otherwise the hemp is liable to an unequal rot. It will require plank placed upon it, weighed down with timbers or stones, in order to keep it well under water. Mr. Myerle recommends vats forty feet long, twenty feet wide, and two feet deep, as best, and the most convenient, for the reason that the hemp is kept cleaner while rotting, and the hands can lay it down in the vats and take it out without getting wet, which is very important to the health of the laborer. These vats also greatly facilitate the operation, and can be fed with water and have it run off at pleasure, without endangering loss from the hemp. Water rotting in streams, requires a longer or shorter period, according to the season. In September, when the water is warm, ten days is generally sufficient; in October, about fifteen, and in December, thirty days or more. For the latitude of Kentucky, October and November are considered the best months for the operation, and perhaps is the easier done, gives more lint, and upon the whole, as good a sample as if deferred later.

Raising Hemp Seed.—It is important that the farmer should be supplied with good seed, which is free from weeds, and this he can only be certain of when he produces it himself. This requires another system of cultivation, but similar soil, which should be in the finest condition as to fertility and pulverization. An old pasture or meadow, heavily manured and plowed in the fall, and well pulverized in the spring, furnishes the best soil. We again quote from Judge Beatty's valuable essay on practical agriculture:

"The seed should be planted as we do corn, either in hills or drills. I prefer the former, because it admits of easier and better

cultivation, as the plow can be used both ways. It is usual to plant five feet apart, each way, and suffer four or five stalks to stand in a hill until the blossom hemp is removed, and then reduce the number so as not to exceed two stalks in a hill. Thus there would be two seed plants for each twenty-five square feet. It would be a better practice to make the hills three feet six inches apart, each way, and thin the hemp to three stalks in a hill, till the blossom hemp appears, and at the proper time cut out the blossom or male hemp; and, if necessary, a part of the seed hemp, so as to reduce the latter to one stalk in the hill. If each hill should contain *one stalk*, there would be two seed stalks for each twenty-four and a half square feet. This will give a greater number of *seed stalks* per acre than planting five feet each way, and leaving two in a hill. According to this plan, each seed plant will stand by itself, and, having its appropriate space of ground, can spread its branches without obstruction. According to the other plan, two seed plants, standing together, will obstruct each other, in putting forth lateral branches, and can scarcely be expected to produce *twice* as much as the single stalk.

"The ground for hemp seed, having been well prepared by at least two plowings, and a number of harrowings, sufficient to pulverize the ground, it should be laid off as above directed, and planted in the same manner as corn, except that the seed need not be covered more than an inch and a half deep. Twelve or fifteen seed should be dropped in each hill, which should be somewhat scattered to prevent them from being too much crowded in the hill. Though good seed is certain to come up, yet it is prudent to plant about the number suggested to guard against casualties. Soon after the hemp seed comes up, a small shovel plow should be run through, both ways, once in a row. If the ground is not foul, the plowing may be delayed till the hemp is a few inches high, which will enable the plowman to avoid throwing the dirt on the tender plants. The hoes should follow the second plowing, and clean away the weeds, if any, in or near the hill, and thin out the hemp to seven or eight stalks. These

should be the most thrifty plants, and separated from each other. The plowing should be repeated from time to time, so as to keep the ground light and free from weeds. And when the plants are about a foot or a foot and a half high, the hoes should again go over the ground and cut down any weeds or grass which may have escaped the plow. The plants should be still further thinned out, at this time, leaving but four in a hill, and some fine mold drawn around the plants, so as to cover any small weeds that may have come up around them.

"After seed hemp has attained the height of a foot and a half, it will soon be too large to plow, but it ought to have one plowing after the last hoeing. The ground, by this time, will have become so much shaded by the hemp plants, as to prevent the weeds from growing, so as to do any injury, and nothing more need be done but for a boy to follow the plow, and (if three and a half feet be the distance of the hills apart,) reduce the number of plants invariably to *three*, taking care to remove those which the last plowing may have broken or injured, by the treading of the horse or otherwise. The next operation will be to cut out the blossom or male hemp. This, according to the opinion of some farmers, should be done as soon as the blossom begins to show, in order to make room for the seed hemp to grow and spread its branches. This opinion must be taken with some allowance. The farina or pollen of the male hemp is necessary to fertilize the seed bearing plants. The seed of the latter would be wholly unproductive, if the *whole* of the male hemp should be cut before its pollen has been thrown out. It is important to cut the male hemp as soon as it has performed its office, because much room is thereby afforded to the seed bearing plants to spread their branches.

"When the seed hemp has so far advanced as readily to distinguish the male from the female plants, let all the blossom hemp be cut out, except one stalk in every other hill, and every other row. This would leave one stalk of male hemp for every four hills. These, together with the stalks which should thereafter

blossom, would be sufficient to fertilize all the seed bearing plants, and secure a crop of *perfect* seed. After the blossom plants, thus left, have been permitted to remain until they have pretty well discharged their pollen, (which can be easily ascertained by dust ceasing to flow from them when agitated,) they, also, should be cut down. Some farmers top the seed plants, when five or six feet high, to make them branch more freely, but this is not necessary where but one or two seed bearing plants are suffered to remain in each hill."

A seed bearing hemp crop is a great exhauster of land, while such as is grown only for the fibre takes but a moderate amount of fertilizing matter from the soil. Unlike most crops sown broadcast, it grows with such strength and luxuriance, as to keep the weeds completely smothered, and it may therefore be grown for many successive seasons on the same field. Its entire monopoly of the ground, prevents the growth of clover, or the grains in connection with it.

The seed yields an oil of inferior value, and when cooked, it affords a fattening food for animals.

COTTON, (GOSSYPIUM,)

Has, for many years past, been the leading agricultural export of the United States. Its enormous product has mainly grown up within the last sixty years. Even as late as 1825, our total production was within 170,000,000 pounds. The introduction of Whitney's cotton gin, in the latter part of the last century, gave the first decided movement towards the growth of American cotton. Previous to this invention the separating of the cotton seed from the fibre was mostly done by hand, and the process was so slow and expensive as to prevent any successful competition with the foreign article. This incomparable invention, which cleaned one thousand pounds in the same time a single pound could be cleaned without it, overcame the only obstacle to complete success, and millions of acres of the fertile lands of the South and West are now annually covered with the snowy product.

Climate and Soil.—Cotton will grow in some of the Middle States, but with little profit north of the Carolinas and Tennessee. The soil required is a dry, rich loam.

Cultivation.—During the winter, the land intended for planting should be thrown up in beds by turning several furrows together. These beds should be four feet from center to center for a moderate quality of upland soil, and five feet for the lowland. But these distances should be increased with the increasing strength of the soil, to seven and eight feet for the strongest lands. Those may lie until the time of planting, from the twentieth of March to the twentieth of April, when no further danger from frost is apprehended; then harrow thoroughly, and with a light plow mark the center of the beds, and sow at the rate of two to five bushels of seed per acre. A drilling machine might be made to answer this purpose better, and save much time. An abundance of seed is necessary to provide for the enemies of the plant, which are frequently very destructive. If all the seed germinates, there will be a large surplus of plants, which must be removed by thinning. The kind of seed used for uplands is Mexican and Petit-Gulf, both of the same variety, but the last is better selected and has been kept pure.

There is an advantage in mixing the seed before it is sown, with moistened ashes or gypsum, as it facilitates sowing and germination. The seed should be buried from one-half to one and a half inches, and the earth pressed closely over it. The subsequent cultivation is performed with various instruments: the bull-tongue or scooter, the shovel, double shovel, the sweep, the harrow, the cultivator and the hoe. One or more of the former must be used to pulverize the land and uproot and clean off the weeds; while the last is necessary to carry this operation directly up to the stem of the plants. The culture is thus summarily stated by Dr. Phillips:

"Commence clearing the cotton early; clean it well; return to it as soon as possible, throw earth or mold to the young plants, and if the ground be hard, give it a thorough plowing; keep the earth light and mellow, and the plants clear of grass and weeds."

The plants are thinned at every hoeing, till they attain a height of three or four inches, when two or three are allowed to stand together at intervals of about eight inches for a medium quality of soil. This distance should be largely increased when it is richer.

Cotton is subject to the cut and army worm, the slug and cat erpillar, cotton lice, rot, sore shin and rust. We have seen no remedies prescribed for either, but we suggest for experiment the exposure of the two former to frost, by plowing just before its appearance. The free use of lime and salt and similar manures might arrest or mitigate the effects of all. Birds should also be encouraged upon the fields, as they would destroy numbers of the worm and insect tribes. It has been claimed that the introduction of the Mexican and Petit-Gulf varieties is the most effectual remedy, as they furnish hardier kinds, which are less the object of attack and have a greater ability to withstand it.

Harvesting is commenced when the bolls have begun to expand and the cotton is protruded, and this is continued from time to time as the bolls successively ripen and burst their capsules. It is done entirely by hand, the picker passing between two rows and gleaning from each. The cotton is placed in a bag capable of containing fifteen or twenty pounds, which is hung upon his shoulders or strapped upon his breast. These are emptied into large baskets, which are taken, when filled, to the gin-house. We quote again from Dr. Phillips:

"Having all things ready for picking cotton, I commence as usual, early, as soon as the hands can gather even twenty pounds each. This is advisable, not only in saving a portion of that from being destroyed, if rains should fall, which often do at this season, (about the middle of August,) but for another reason; passing through the cotton has a tendency to open out to sun and air the limbs that have interlocked across the rows, and hastens the early opening. On low grounds, especially, much loss is incurred in some seasons from the want of the sun to cause an expansion of the fibre within the boll, so as to cause it to open.

The boll is composed of five divisions, in each of which there is a parcel of cotton wool surrounding each seed, there being several in each *lock* of cotton. When green, these fibres lie close to the seed, and as it ripens, the fibres become elastic, the boll becoming hard and brownish.

"The Sea Island has only three divisions, as also the Egyptian, which is only the Sea Island of the best variety, with black seed, smooth, and a yellowish tuft of fibres on the small end; they are both from Pernambuco. Some of the cotton we plant has only four divisions, but I think five generally. There is a peculiar art in gathering the cotton from the boll, which, like handling stock, can only be acquired by practice; many gather equally fast with either hand. The left hand seizes the stem near the open boll, or the boll between the two middle fingers, the palm of the hand up; the fingers of the right hand are inserted tolerably low down in the boll, a finger on each lock of cotton; then, as the fingers grasp it, there is a slight twisting motion, and a quick pull, which, if done well, will extract the contents, the boll being open, and the bottom of the locks not gummy to adhere.

"There is a vast difference in hands—not the quickest making the best pickers—a steady, clocklike motion, with some quickness, is necessary to gather fast. A neighbor of mine, when a young man, some ten years since, gathered four hundred pounds, which was at that time the best I had known; this has been beaten since, by aiding the hand in emptying his sacks, and almost feeding and watering him while at work.

"Cotton should be gathered from the field as clean as possible, taken to the scaffolds and dried until the seed will crack when pressed between the teeth; not crush or mash, but crack with some noise. It should be frequently turned over and stirred, (all the trash and rotten pods taken out while this is being done,) so as to insure its drying earlier.

"If seeds are wanted for planting, gin the cotton immediately, and spread the seed over the floor some five inches thick, until

perfectly dry. If the cotton seed be not wanted, pack the seed cotton away into the house, to remain until a gentle heat is discovered, or until sufficient for ginning; after it has heated until a feeling of warmth to the hand, and it looks as if pressed together, open out and scatter to cool. This cotton will gin faster, have a softer feel, is not so brittle, therefore not so liable to break by rapidity of gin, and has a creamy color; the wool has imbibed a part of the oil that has exuded by the warmth of seed, and is in fact restored to the original color; for the oil being vegetable, it is dissipated by sun and air, and the color by moisture (of rain and dews) and light. I have known of a number of sales made of this description of cotton, and even those who are most strenuous against the heating, admit it bore a better price." The cotton is then ginned and baled, when it is ready for market.

Topping Cotton between the twentieth of July and twentieth of August, is practiced by many planters with decided success. It is thought by the foregoing authority, highly beneficial in dry seasons, but not in wet, and that in three years out of five, it is attended with particular advantage to the crop.

Sea Island Cotton requires in many respects a treatment unlike that of the upland. We insert an article by Thomas Spalding, Esq., who has long been engaged in its cultivation.

"The Sea Island cotton was introduced into Georgia from the Bahamas; the seed was from a small island near St. Domingo, known as Arguilla, then producing the best cotton of the Western world. It in no way resembles the Brazil cotton, which is the kidney seed kind, introduced some years later, and which after trial, was rejected in Georgia. This seed came in small parcels from the Bahamas in the winter of 1785. It gradually and slowly made its way along the coast of Georgia, and passed into Carolina, from the year 1790 to 1792. The winter of 1786 in Georgia, was a mild one, and although the plants of the Sea Island cotton that year had not ripened their seed, it being a perennial, and subject only to be killed by frost, it started the

next season (1787) from the roots of the previous year, its seed ripened, and the plants became acclimated. Many changes have come over this seed since that time, from difference of soil, of culture, and local position; and above all, from careful selection of seed. But it requires to be discovered, that what is gained in fineness of wool, is lost in the quality and weight of the product; for in spite of a zeal and intelligence brought to act upon the subject without parallel, the crops are yearly diminishing; until to grow Sea Island cotton is one of the most profitless pursuits within the limits of the United States.

"The Culture.—When the Sea Island cotton seed was introduced in 1786, it was planted in hills prepared upon the level field, at five feet each way; but it was soon learned, that of all plants that grow, it is in its first vegetation and early stage the most tender; liable to suffer by storms, by wind, by drought, and by excess of rain. The quantity of seed was therefore increased, and the plants multiplied, until, as in most other cases, one extreme produced another. For many years, however, among experienced planters, the course is to divide their enclosed fields into two portions; the one at rest, the other in culture.

"Preparing the Land for the Crop.—Early in February, any hands not engaged in preparing the previous crop for market, are employed in cleaning up the rested fields, and either in burning off the fennel weeds and grass of the previous year, or in listing them in at five feet apart, to serve as the base of the future ridges or bed. There is much difference of opinion, upon the subject of burning or listing in; for myself, I am inclined to take the first opinion, believing that the light dressing of ashes the field receives from burning off, is more beneficial to the soil than the decay of the vegetable matter, and renders it less liable to produce what is a growing evil, the rust, a species of blight, much resembling the rust or blight upon wheat, and which takes place about the same period, just as the plant is putting out and preparing to ripen its fruit.

"Ridging.—The land being listed in short lines across the entire field, at five feet apart, the operation of ridging is commenced about the first of March. The ridges occupy the entire surface; that is, the foot of one ridge commencing where the other ridge ends, and rising about eight inches above the natural level of the land, thus presenting a surface almost as smooth, and almost as deeply worked as a garden bed. This ridging is carried on but a few days ahead of the planting. The ridge, if the operation has been carefully done, is from two to two and one-half feet broad at the top; it is then trenched on the upper surface with the hoe, six inches wide, and from three to six inches deep, depending upon the period of planting.

"Planting.—In the beginning, if the seed is covered more than two inches with soil, the soil will not feel the influence of the sun, and the seed will not vegetate later; that is, in April up to the first of May, you must give from three to four inches of covering to preserve the moisture, or there, too, you fail from an opposite cause, the wind and burning influence of the sun drying the soil too much for vegetation. In most countries, after sowing the seed the roller is applied; but in cotton planting, in our ridge-husbandry, the foot, in covering the seed and pressing down the earth well supplies its place.

"Quantity of Seed per Acre.—A bushel of seed is generally sown to the acre; I believe half a bushel is better, for where the evil comes, whether the worm, or wind, or drought, or wet, there is no security in the many; but on the contrary, where they come up thin, they soon grow out of the way of injury from any enemy.

"After Culture.—The cultivation of Sea Island cotton is carried on by the hand hoe, and the quantity always limited to four acres to the laborer. The operation of weeding commences as soon as we finish planting, because in our flat and sandy soils the grass seed springs with the first growth of the cotton, and by the time we finish planting, say the first of May, what we planted in March requires the hoe. The land is kept in the operation of

hoeing and weeding as far as may be, at its original level, the beds neither increased or diminished, that rains which generally fall with beating power, and in redundant quantity, in the month of August, may as little as possible injure the growing plants, which are then in full bearing. The young cotton is thinned out slowly at from six to twelve inches apart on the ridge, by the tenth of June. As soon as the rains commence, which is about the last of July, it is wise to leave nature to herself, and no longer disturb the soil; four hoeings if well done, and the grass well picked at each hoeing, is enough; nor does any aftergrowth of grass do injury.

"MANURES AND SOILING STOCK.—For some years past, great efforts have been made by the Sea Island planters, in manuring. Much of the alluvion of our salt rivers have been collected, and sometimes placed directly in heaps through the fields at rest, at other times placed in cattle pens, on which cotton seed, and all waste materials are strewn, and the cattle pounded up on it. But what is preferred, is to pen our cattle near the river at night, and cut salt grass, which covers these alluvion lands, and which is as nutritious as so much clover. Great benefits will result from the use of marl, I have no doubt, hereafter.

"AMOUNT OF CROP PER ACRE, AND PICKING.—It has been stated already, that 500 pounds to the acre is about the medium crop, which at twenty cents per pound, is to the planter $100 for gross crop; and from this hundred dollars is to be subtracted the expense of cultivation, bagging, freight, and expenses of sale."

THE VARIETIES which have been cultivated with success in the United States, in addition to those enumerated, are *the Rio*, with a staple about three inches in length, of a glossy, silky texture, brought from South America; *the Egyptian*, received from the garden of Mehemet Ali, and grown in Louisiana fifteen feet in height; *the Mastodon*, lately introduced from Mexico, firm in texture and highly productive; *the Chinese Silk Cotton*, white, soft, fine and silky; *the East India*, growing to a height of fourteen feet, and producing a beautiful fibre; and *the Nankeen*, a

handsome staple of a true nankeen color, raised by the late Hon. John Forsyth, of Georgia, and some other planters.

Cotton Seed.—The amount of seed in cotton is large, being nearly 70 per cent. of the entire gathering, the fibre being about 28. This is used for various purposes. Sometimes it is pressed for its oil, of which it yields from 15 to 20 per cent. of its own weight. When thus treated, the cake is used for cattle food. The seed is frequently though improperly fed raw to stock, and this often proves fatal, especially to swine, besides being attended with much waste. It is most advantageously prepared by boiling for half an hour, when it will benefit all descriptions of stock. By adding an equal quantity of corn and boiling them together it will fatten swine rapidly. It is also useful to land as a manure.

THE SUGAR CANE, (SACCHARUM OFFICINARUM.)

The cultivation of the cane is an important branch of Southern agriculture. Its first introduction into this country, is said to have been in 1751, by some French jesuits, who planted it on the present site of New Orleans. But it was not until between 1794 and 1800, when the revolution in St. Domingo sent hundreds of their planters into that State, that the growth of the cane became an object of decided importance. They brought with them the small yellow Creole, the only kind then cultivated in the French West India islands. From these limited and comparatively recent beginnings, the product has rapidly increased, until it has now become next to cotton, the great agricultural export from the Southern States.

In Louisiana, the great sugar producing State, it has been cultivated almost exclusively on the low or rich level lands; but recently, the more elevated country has been used for it, and the experiments have been such as to justify the expectation that large quantities will hereafter be raised on the uplands. The cane was brought to Georgia in 1805 from the island of Otaheite. Its extension in some parts of that State and Florida was rapid, until the breaking out of the late civil war in the Southern

States, and with the return of their accustomed industry, sugar will again become a heavy staple in those States, and in some portions of Texas.

Cultivation.—The first operation is to drain the land effectually with large open ditches, by which all the surface water is removed. The ground is then thoroughly prepared with the plow, and well harrowed if rough. "In Georgia," says Mr. Spalding, "the cane was cultivated differently from what it was elsewhere. It naturally took the course of cotton culture of the sea-coast, to wit: ridges at five feet apart; a trench was opened on the top of the ridge, three inches deep, in which a double row of cane plants were placed, cut about two feet long, and placed so as the eyes which are alternate, should be on the sides, and then covered with two inches of earth. This you may suppose in a good season gives a continued line of stalks, not more than three inches apart, and throwing up cane five or six feet, fit for the mill. I have often supposed that there was growing of vegetable matter to the acre, from thirty to forty tons, certainly containing more nutritious matter for stock, than any other plant would give upon the same surface. In Louisiana they planted altogether with the plow, and had their trenches not more than two and a half feet apart; they have since gradually widened their distance. When I was there, they used generally the old-French plow, with a wheel at the end of the beam. With strong teams, they plowed deep and better than anywhere I had seen in the Southern States. It was by means of the plow, that they planted so many acres to the laborer; and again, because they had little grass upon their river lands except the nut grass."

The cane may be planted any time between the months of September and March; but is usually done in January and February, after the sugar making is completed. Some planters have recently obtained large crops by planting in rows at a distance of eight feet apart. After the frost has disappeared, the earth is removed by the plow from each side of the cane, and the top earth is scraped off to prevent early vegetation. It is then kept

clear of weeds and grass by the frequent use of the hoe, till it has produced suckers or shoots enough to afford a full stand. In the latter part of May or early in June it should be hilled about four inches, and then left unmolested till ready for the mill. The cane begins to ripen at the bottom in August or September, and advances upwards at the rate of about six inches per week, and is usually fit for the mill by the middle of October.

Harvesting.—The cane is first topped while standing, which consists in cutting off the upper end of the stalk as far as the leaves are dry. The dry leaves are then stripped from the standing stalk, and the cane cut with a cane knife close to the ground, and carried in carts to the mill, where it is at once passed through the rollers for expressing the juice. This last is immediately put into the kettles, boiled, skimmed, and reduced to the proper point for granulation or conversion into sugar. The tops and leaves are frequently left on the ground for manure, or used for stock feeding, and sometimes they are planted. But it is better to use the choicest whole cane for this purpose; and when thus selected, it is cut before frost and laid down in beds or *matelas* one or two feet in thickness, with the tops overlapping and occupying the surface like shingles in a roof.

Cane is generally planted in this country once in three years, and it continues to grow vigorously for this period from a single planting. In St. Domingo, many of the cane fields are irrigated from the mountain streams, by which the crop is largely increased, and the ratoons or old plants last for several years. Mr. Spalding places the average crop of the uplands in Georgia at 500 pounds of sugar per acre, and that of the bottom or river lands, at 1,000 pounds, while that of Louisiana is estimated at 800 pounds. The crushed cane is frequently used for fuel where wood is scarce. This is a wasteful custom, as it is a valuable food for stock. Large quantities of the molasses have heretofore been used for distilling into alcohol, but the manufacture of this has materially lessened of late, and a salutary change has been made in its disposal. When it would not bring a remunerating price for

exportation, as has sometimes been the case in the West Indies, it has been mixed with other materials and fed to stock. It is healthful and exceedingly fattening to animals. It may become an economical question whether there cannot be found a mode of drying and storing the expressed cane, or *bagasse*, to be cut up in the same manner as hay, in a cutting box, and mixed with ground grain, as food for farm stock, and thus consumed on the plantations, where the cane is grown. Great quantities of hay are annually shipped from the States north of the sugar region, for consumption there, and why not use the bagasse as well? Its fibre is woody, and perhaps harsh in its dried condition. But it can be steamed or cooked in the manner that comparatively worthless straw, mixed with grain meal, is cooked and fed to dairy cows and other stock at the North. The sweetness is not *all* expressed from the cane in the grinding mills, and much of excellent nutriment still remains. The valuable quality of sweetness still remaining in it is palatable to the cattle, and fattening in its qualities. In the common way of its use as fuel, it is comparatively, or if thrown away, altogether lost.

The blue ribbon is the most prolific and extensively cultivated variety on the rich lands of Louisiana. The Otaheite is largely raised, and with the Creole or Brazilian, (now nearly superseded,) makes up the cultivated varieties of the United States.

The Cane Coverer, recently invented by Mr. Bryan, it is affirmed, will save a large amount of labor, a boy and span of horses covering with it ten acres in a day, and it is equally efficient in removing the earth from the cane. *The hydraulic press* has been lately introduced for expressing the cane juice, which it does at the rate of 6,000 gallons in every ten hours, either by manual labor or with the aid of a couple of mules. The advantages claimed for it are numerous and striking. The *application of steam* to the manufacture of sugar, has been generally introduced into Louisiana and the other sugar States, by which 18,000 pounds have been made in twenty-four hours, with great economy and advantage.

SORGHUM SUGAR CANE, (SORGHUM SACCHARINUM.)

Within a few years past, this *syrup* producing plant has become of great importance in the Middle and Western States, as well as in the Southern States lying north of the cane sugar zone, and may possibly be rendered still more so, in the labor revolutions which have lately taken place in the cane sugar regions.

It is an ancient plant, long cultivated in Asia and Africa, for its saccharine qualities, and next to the tropical cane, perhaps more productive than any other. Its success in making sugar has not yet been profitably demonstrated in America, owing, possibly, to imperfections in the mode of crystallization. But if it will simply produce molasses, its value can be scarcely too greatly magnified, in the economies of our soil productions.

There are several varieties, as the African Imphee, and others, but the Chinese, now most generally cultivated, appears to be most highly approved, for productiveness, and mild and pleasant flavor.

Soil and Cultivation.—Like Indian corn, the sorghum is, in its roots, deep and wide spreading, and like that, requires a thoroughly drained, warm, free, and good soil to promote its sweet flavor—wet and cold soils contributing but slightly, or in a much less degree, to its development. It should be planted, too, at about the same season as corn, and receive frequent and clean cultivation. Heavy, unctious barn-yard manures should not be applied to the crop, giving it too rank a growth. Well rotted, or compost manures are better, or it may be grown on soils succeeding a crop to which such manures have been previously and lately applied. Lime, ashes, salt, guano, and the phosphates generally, are excellent manures, giving a *medium* growth to the stalk, and promoting the development of the saccharine juice in a higher degree than the more stimulating *humus* of the heavier fertilizers. It is, in fact, a cultivation by itself, but no more intricate, or difficult, than that of Indian corn, the proper land being once selected; and as a general rule, good corn land will produce good sorghum.

In growth it much resembles broom corn, being small when it first comes up, and should be planted, and, in its early stages, worked pretty much like it. It also tassels out somewhat like it, only that the seed stems run up pointedly, instead of equally.

Time and Manner of Harvesting.—This should be done before the first sharp autumnal frosts. The sorgho ripens unequally, or *unevenly* rather, some stalks being fit to cut a few days before others; but as it should not be left to fully ripen before cutting, this inequality in maturity, when favorably grown, is of no particular injury. It should be cut near the ground; the two top joints be cut off and thrown aside, being too weak and crude in their sap to add to the quality of the cane below.

As soon after cutting as possible, it should be removed to the crushing, or grinding mill, and put under cover from storms, or the drying heat of the sun, that its juices be not tainted by mold, or too much dried by condensation, to be easily expressed. As soon after cutting as possible, the canes should go into the mill for crushing.

Grinding, Evaporation, and its Manufacture into Syrup.—This is a process by itself, and through which the ordinary farmer, who rears the crop only for his own family supply, cannot enter profitably to the best advantage. A detail of its full operation, would require a treatise far beyond the limits of our work, but which, fortunately, is well understood in all neighborhoods where sorghum is grown, and easily learned by any intelligent inquirer. It is a simple process, so far only as the making of syrup is concerned, while its further manufacture into sugar requires the aid of chemicals, and an educated study into its varied and more intricate processes.

Mills made of iron, and driven by either horse, steam, or water power, are extensively made for the purpose of crushing, while boilers, or evaporators, specially made for that object, are attached to complete the operation, from which the finished article is drawn off and barrelled for consumption. The mills are of various capacity, suited to the amount of cane grown in their immediate

vicinity, accommodating many different growers of the cane, and in such way only, is the syrup made really profitable.

Uses.—Where the cane is properly grown and manufactured, the syrup is a mild, rich and delicious sweet—much superior to the common West India, or New Orleans molasses in most kinds of cookery, or to eat on puddings, or cakes, when such flavoring is required. Where it can be readily produced, it is an article of cheap cultivation, and great household economy. In such localities, its production should be recommended, more or less, as a portion of the farm crop, for syrup, if nothing else.

Its manufacture into sugar, as yet, has not been particularly successful, although further trials may, it is hoped, result in eminent success. Should it so result, an untold source of wealth and luxury may be found in wide portions of the country now dependent on other climates and countries, which draw off no small amount of the avails of other portions of our industry.

MAPLE SUGAR.

The rock, hard or sugar maple tree, (*Acer Saccharinum*,) is among our most beautiful shade, and most valuable forest trees, and it stands next to the sugar cane and sorgho in the readiness, and abundance with which it yields the material for *cane sugar*. When refined, there is no difference either in appearance or quality between the sugar from the cane, the maple, or the beet. In the brown state, the condition in which it is sent to market, when made with care and formed into solid cakes, it retains its peculiar moisture and rich aromatic flavor, which makes it more acceptable to the nibblers of sweets, than the most refined and highly scented *bon-bons* of the confectioner. The quantity made in this country, is very large, though from the fact of its domestic consumption, and its seldom reaching the large markets, there is no estimate of the aggregate production which will come very near the truth. Both the sugar and *syrup* are used for every purpose for which the cane is employed.

The sugar maple extends from the most northern limits of Maine and the shores of Lake Superior, to the banks of the Ohio.

Further south, it is rarely found. The cane and maple approach each other, but scarcely meet, and never intermingle as rivals in the peculiar region which nature has assigned to each. In some sections of the country, tne sugar maple usurps almost the entire soil, standing side by side, like thick ranks of corn, yet large and lofty, and among the noblest specimens of the forest. The writer has thus repeatedly seen them around the Manitouwoc river, near the coast of Lake Michigan, in Wisconsin, and in the beautiful *sugar orchards* of the same country, where, unlike the others, they grow in open land among the rich native grasses, their tops graceful and bushy like the cultivated tree, and but for their great numbers and extent, and their more picturesque grouping, one would think the hand of taste and civilization had directed what nature alone has accomplished. And amid those beautiful orchards, or in the depths of those dense, dark woods, the Indian wigwam and the settler's rude cabin may of late been seen, filled with the solid cakes and mokoks,* which contain from thirty to sixty pounds of their coarse grained, luscious sugar.

The season for drawing and crystallizing the sap, is in early spring, when the bright sunny days and clear frosty nights give it a full and rapid circulation. The larger trees should be selected and tapped by an inch auger, to the depth of an inch or more, but not through the alburnum of the wood, the hole inclining downward, to readily pass off the sap. At the base of this, a sharp, gouge shaped piece of galvanized sheet iron, a few inches long, and an inch to an inch and a half wide, should be driven into the bark, to conduct the sap into the bucket below.

It is contended, however, by many good and experienced sugar makers, that it is a better way to *box* the trees by cutting with a gouge, a narrow, *slanting upward* channel, three or four inches

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* Mo-kok—An Indian sack or basket, with flattish sides and rounded ends, similar in fashion to a ladies' traveling satchel. They are made perfectly tight, of strips of white birch bark, sewed with thongs of elm. They make some of their sap buckets of the same material, but different in form. The small mo-koks, tastefully ornamented with various colored porcupine quills and filled with maple sugar, are sold for toys.

long, an inch or so into the wood of the tree, and inserting the iron spout below, as in the auger method, as it will draw an equal or a greater amount of sap, and sooner heal over, with less detriment to the tree, and in much less time, as it is never tapped during several successive years in the same place.

When the sugar season is over, if holes are bored, they should be closely plugged, and the head cut off evenly with the bark, which soon grows over the wound. If carefully managed, several borings, or small cuts, during the same season, may be made in a large and thrifty tree, without any apparent injury to it. The barbarous, slovenly mode of half girdling the tree with an ax, soon destroys it.

The sap is collected daily, with buckets which are carried on the neck by a milkman's yoke to the boilers; or if the quantity be great and remote from the sugar fires, by a hogshead placed on a sled, with a large hole at the top, covered with a cloth strainer, or a tunnel, similarly guarded, is inserted in the bunghole. The primitive mode of arranging the sugary, is with large receiving troughs, (or much better, tanks,) placed near the fires, capable of holding several hundred gallons of sap, and the boiling kettles suspended on long poles supported by crotches.

The process of sugar making, we give from the statement of Mr. Woodworth, of Watertown, N. Y., who obtained the premium from the State Agricultural Society, for the best sample of maple sugar, exhibited at the annual fair of 1844. We saw the sample alluded to, and no maple sugar, or even any other kind, could be purer or finer. Of later years, different and lighter made metal evaporators than potash kettles, have come into use, somewhat like the sorghum evaporators, in which a light colored and purer article is made, at less expense of manipulation. When such can be obtained, and of unimpeachable quality in strength, we do not hesitate to recommend their use, instead of the old and heavier boilers.

The statement says: "In the first place, I make my buckets, tubs, and kettles, all perfectly clean. I boil the sap in a potash kettle, set in an arch in such a manner that the edge of the ket-

tle is defended all around from the fire. I boil through the day, taking care not to have anything in the kettle that will give color to the sap, and to keep it well skimmed. At night I leave fire enough under the kettle to boil the sap nearly or quite to syrup by the next morning. I then take it out of the kettle and strain it through a flannel cloth, into a tub, if it is sweet enough; if not, I put it in a caldron kettle, which I have hung on a pole, in such a manner that I can swing it on and off the fire at pleasure, and boil it till it is sweet enough, and then strain it into the tub and let it stand till the next morning; I then take it, and the syrup in the kettle, and put it altogether in the caldron and sugar it off. I used, to clarify say one hundred pounds of sugar, the whites of five or six eggs, well beaten, about one quart of new milk, and a spoonful of saleratus, all well mixed with syrup before it is scalding hot. I then make and keep a moderate fire directly under the caldron, until the scum is all raised; then skim it off clean, taking care not to let it boil so as to raise in the kettle before I have done skimming it. I then sugar it off, leaving it so damp that it will drain a little. I let it remain in the kettle until it is well granulated. I then put it into boxes, made smallest at the bottom, that will hold from fifty to seventy pounds, having a thin piece of board fitted in, two or three inches above the bottom, which is bored full of small holes to let the molasses drain through, which I keep drawn off by a tap through the bottom. I put on the top of the sugar in the box, two or three thicknesses of clean, damp cloth, and over that a board, well fitted in so as to exclude the air from the sugar. After it has done, or nearly done draining, I dissolve it and sugar it off again, going through the same process in clarifying and draining as before."

When sap is not immediately boiled, a small addition of lime water should be made to check fermentation, which prevents the granulation of the syrup. A single tree has yielded in one day, twenty-four gallons of sap, making over seven and a quarter pounds of sugar; and in one season it made thirty-three pounds. Trees will give an average of two to six pounds in a single season.

There are sugar maple lands throughout all our Northern and Middle States, which in many localities can be more profitably devoted to sugar making, than almost anything else. These are highly elevated, or rocky positions, with a warm, open soil, where the maple grows freely, and the sap attains a remarkable sweetness. They grow, too, on many frosty lands, where grain cannot grow, and on hillsides, that cannot well be cultivated in anything but pasturage. It is a question of calculation, therefore, with the proprietor, with an original growth of trees upon such lands, whether to let them remain for sugar making, or to clear them for simply agricultural uses. Indeed, if devoted solely to sugar, all other wood growth should be cut out, when the maples stand thick enough, so that they may have the whole ground to themselves, and let the sun and air into them, thus promoting their growth and giving them an abundant flow of sap. In such cases, the land can be sown in grass and afford considerable good pasturage.

It is a long time to look ahead, perhaps, but we see no good reason why certain favorable lands for the growth of maples, and not valuable for much else, may not be planted, even, for future sugar orchards. When grown to a foot in diameter near the ground, they may be tapped and made productive.

TOBACCO, (NICOTIANA.)

This narcotic is a native of North America, and has been an object of extensive use and cultivation in this country, since the first settlement of Virginia, in the latter part of the sixteenth century. It formed, for a long time, the principal export from that colony and Maryland. Kentucky for many years has been a large producer, exceeding even Virginia, and of late years, Missouri and other Western States have embarked largely in its growth. It is also cultivated to some extent in New York, in the Connecticut valley, and some other localities in New England, where it is profitably produced for the making of cigars, particularly *wrappers*.

The Soil may be a light loamy sand, or it may be alluvial, well drained and fertile. New land, free of weeds and full of saline matters, is best suited to it, and next to this is a rich grass sod, which has long remained untilled. The seed should be sown in beds which should be kept clean, as the plant is small and slow of growth in the early stages of its existence, and is easily smothered by weeds. If not newly cleared, the seed beds should be burned with a heavy coating of brush.

Cultivation.—The beds should be well pulverized, and the seed sown at the rate of a table spoonful to every two square rods. The seeds are so minute, that sowing evenly is scarcely attainable, unless by first mixing with three or four times its bulk of fine mold. This should be done sufficiently early to secure proper maturity to the plants, in time for transplanting, (say by the last of February or early in March, south of the Ohio and Potomac, and about the first of April, north of them,) covering lightly, and completely rolling or treading down the earth. The plant appears in fifteen or twenty days, and will be fit for transplanting in six or eight weeks. This should be done in damp weather, and the plants set singly, at a distance of two and a half to three feet each way. The after culture is like that of corn, and consists of frequently stirring the ground, with the plow, or cultivator and hoe, and keeping down weeds. The places of such plants as fail, or are blighted, must be at once filled up, and all worms destroyed.

The Priming, Topping and Suckering, are necessary operations. The first consists in breaking off four or five of the leaves next the ground which are valueless; the second is taking off the top, to prevent the seed stalk from developing, and is regulated by the kind of tobacco. The first topping will always admit of a greater number of leaves being left; and in proportion as the season advances, fewer leaves should be left. The heavier kinds of tobacco are generally topped, early in the season, to twelve leaves, then to ten, and still later to eight. The lighter kinds are topped to a greater number of leaves. If the soil is light, fewer

leaves should be left. Suckering consists in breaking off the young side shoots, which should be done immediately after they make their appearance.

Harvesting may be commenced with such plants as have become sufficiently ripe, which is indicated by greenish, yellow spots on the leaves. This will generally occur in August at the South, and in September at the North. The stem of the plant is cut near the ground, and allowed to wilt, but not exposed to a hot sun. If there is danger of this, it should be cut only in the morning or evening. When properly wilted, which will be in a few hours, it may be carefully carried to the drying house, where it should be hung up by twine tied to the butt end of the stalk, and suspended over poles, at drying distances, with the head downwards. The circulation of air is necessary in the drying houses, but there must be entire safety against storms or winds, as the leaves are liable to break by agitation, and rain seriously injures them. When the stem in the leaf has become hard, it is sufficiently dried. This takes place in good weather, in two or three months. The leaves may be stripped in damp weather, when they will not crumble, and carefully bound in small bundles, termed hands, and then boxed for shipment.

The Varieties of tobacco are numerous, not less than twelve being cultivated in America, and they are adapted to the different soils and climates where they are grown. The most fragrant are produced in Cuba, and are almost exclusively used for cigars. They command several times the price of ordinary kinds. The leaves of the Connecticut river tobacco are now largely used as cigar *wrappers*, being of excellent quality for that purpose. The tobacco of Virginia, Maryland, Kentucky, and some adjoining States, is peculiarly rich and high flavored, and is most esteemed for chewing.

Much of the peculiar flavor and value of tobacco depends on the soil, and the preparation or sweating of the plant after drying. The former should not be too rich, and never highly manured, as the flavor is thereby materially injured though the

product will be increased. Yet it is an exhausting crop, as is seen by the large quantity and the analysis of the ash, and the soil requires a constant renewal of well fermented manures, and particularly the saline ingredients, to prevent exhaustion. Tobacco contains nitrogen and the alkalies in large quantities, and but very little of the phosphates. The ash is shown in the analysis of Fresenius and Will, to consist of potash, 30.67; lime, (mostly, with a little magnesia,) 33.36; gypsum, 5.60; common salt, 5.95; phosphates, 6.03; silica, 18.39; in 100 parts of the ash. The inferior kinds contain a large proportion of lime; and the superior, the largest of potash. The customary method of burning fuel on the beds designed for tobacco, and the use of freshly cleared and burnt lands, by which the largest crops of the best quality are obtained, shows conclusively the proper treatment required. By each of these operations, the ground is not only loosened in the best possible manner, and all insects and weeds destroyed, but *the salts, and especially potash*, are produced in the greatest abundance. Some of the best soils in Virginia have been ruined by a constant succession of tobacco crops, the necessary result of neglect in supplying them with the constituents of fertility so largely abstracted. The yield per acre is generally from 1,500 to 2,500 pounds, and it is a profitable crop when the best kinds are properly cultivated, under favorable circumstances of soil, climate, etc.

INDIGO, (INDIGOFERA TINCTORIA,)

Was formerly cultivated at the South to a limited degree, but the introduction of cotton and the great profits which it yielded, and its consequent rapid extension, drove the culture of indigo on to foreign soils. The increasing consumption of indigo in this country, will probably again make it an object of agricultural attention in those States where the soil and climate are suited to it. We have no detailed history of its cultivation in the United States, and we quote from Loudon. He says:

"It is one of the most profitable crops in Hindostan, because labor and land here are cheaper than any where else; and

because the raising of the plant and its manufacture may be carried on without even the aid of a house. The first step in the culture of the plant is to render the ground, which should be friable and rich, perfectly free from weeds, and dry, if naturally moist. The seeds are then sown in shallow drills, about a foot apart. The rainy season must be chosen for sowing, otherwise, if the seed is deposited in dry soil, it heats, corrupts, and is lost. The crop being kept clear of weeds, is fit for cutting in two or three months, and this may be repeated in rainy seasons every six weeks. The plants must not be allowed to come into flower, as the leaves in that case become dry and hard, and the indigo produced is of less value; nor must they be cut in dry weather, as they would not spring again. A crop generally lasts two years. Being cut, the herb is first steeped in a vat till it has become macerated, and has parted with its coloring matter; then the liquor is let off into another, in which it undergoes the peculiar process of beating, to cause the fecula to separate from the water. This fecula is let off into a third vat, where it remains some time, and is then strained through cloth bags, and evaporated in shallow wooden boxes placed in the shade. Before it is perfectly dry, it is cut in small pieces of an inch square; it is then packed in barrels, or sewed up in sacks, for sale."

Indigo can only be raised to advantage in our most southern States. The soil requires to be dry, finely pulverized, and rich. The seed is sown early in April, in drills about eighteen inches apart, and the weeds are kept down with the hoe. It should be cut with a sickle or scythe, when the lower leaves begin to turn, and just before the plant is going into flower. This period occurs in this country about the middle of summer. A second crop may be taken the first of autumn, and in hotter climates even a third one.

It has been estimated that Louisiana will raise from forty to sixty pounds of indigo, not inferior to the best Caraccas, selling at two dollars per pound. It takes only from July to October to mature, and it does not demand one-third of the time or

expense for raising, as that of a cotton crop. The consumption of indigo in this country, amounts to several millions of dollars, annually. *There are several varieties indigenous to the Southern States*, and one or more in the Northern, which yield inferior dye.

MADDER, (RUBIA TINCTORUM,)

Used for several dyes, but principally for the rich madder red, has long been an object of attention in the United States. The introduction of this, with numerous other articles consequent upon the extended growth of our manufactures, shows the intimate and mutually beneficial effects of associating the two leading industrial occupations of agriculture and manufactures. The principal cause which has prevented its cultivation among us, thus far, has been the long time required for maturing a crop. We subjoin a description of its culture, from Mr. Bateham.

SOIL AND PREPARATION.—"The soil should be a deep, rich, sandy loam, free from weeds, roots, stones, etc., and containing a good portion of vegetable earth. Alluvial bottom land is the most suitable; but it must not be wet. If old upland is used, it should receive a heavy coating of vegetable earth, (from decayed wood and leaves.) The land should be plowed very deep in the fall, and early in the spring apply about one hundred loads of well rotted manure per acre, spread evenly, and plow in deeply, then harrow till quite fine and free from lumps. Next, plow the land into beds four feet wide, leaving alleys between, three feet wide, then harrow the beds with a fine, light harrow, or rake them by hand so as to leave them smooth, and even with the alleys; they are then ready for planting.

PREPARING SETS AND PLANTING.—"Madder sets, or seed roots, are best selected when the crop is dug in the fall. The horizontal uppermost roots, (with eyes,) are the kind to be used; these should be separated from the bottom roots, and buried in sand, in a cellar or pit. If not done in the fall, the sets may be dug early in the spring, before they begin to sprout. They should be cut or broken into pieces, containing from two to five eyes each; *i. e.*

three to four inches long. The time for planting is as early in spring as the ground can be got in good order, and severe frosts are over, which, in this climate, is usually about the middle of April. With the beds prepared as directed, stretch a line lengthwise the bed, and with the corner of a hoe make a drill two inches deep, along each edge and down the middle, so as to give three rows to each bed, about two feet apart. Into these drills drop the sets, ten inches apart, covering them two inches deep. Eight or ten bushels of sets are requisite for an acre.

After Culture.—"As soon as the madder plants can be seen, the ground should be carefully hoed, so as to destroy the weeds and not injure the plants; and the hoeing and weeding must be repeated as often as weeds make their appearance. If any of the sets have failed to grow, the vacancies should be filled by taking up parts of the strongest roots and transplanting them; this is best done in June. As soon as the madder plants are ten or twelve inches high, the tops are to be bent down on to the surface of the ground, and all except the tip end, covered with earth, shoveled from the middle of the alleys. Bend the shoots outward and inward, in every direction, so as in time to fill all the vacant space on the beds, and about one foot on each side. After the first time covering, repeat the weeding when necessary, and run a single horse plow through the alleys several times to keep the earth clean and mellow. As soon as the plants again become ten or twelve inches high, bend down and cover them as before, repeating the operation as often as necessary, which is commonly three times the first season. The last time may be as late as September, or later, if no frosts occur. By covering the tops in this manner, they change to roots, and the design is to fill the ground as full of roots as possible. When the vacant spaces are all full, there will be but little chance for weeds to grow; but all that appear must be pulled out.

The Second Year.—"Keep the beds free from weeds; plow the alleys and cover the tops, as before directed, two or three times during the season. The alleys will now form deep and

narrow ditches, and if it becomes difficult to obtain good earth for covering the tops, that operation may be omitted after the second time this season. Care should be taken, when covering the tops, to keep the edges of the beds as high as the middle; otherwise the water from heavy showers will run off, and the crop suffer from drought.

THE THIRD YEAR.—"Very little labor or attention is required. The plants will now cover the whole ground. If any weeds are seen, they must be pulled out; otherwise their roots will cause trouble when harvesting the madder. The crop is sometimes dug the third year; and if the soil and cultivation have been good, and the seasons warm and favorable, the madder will be of good quality; but generally, it is much better in quality, and more in quantity, when left until the fourth year.

DIGGING AND HARVESTING.—"This should be done between the twentieth of August and the twentieth of September. Take a sharp shovel, or shovels, and cut off and remove the tops with half an inch of the surface of the earth; then take a plow of the largest size, with a sharp coulter and a double team, and plow a furrow outward, beam deep, around the edge of the bed; stir the earth with forks, and carefully pick out all the roots, removing the earth from the bottom of the furrow; then plow another furrow, beam deep, as before, and pick over and remove the earth in the same manner; thus proceeding until the whole is completed.

WASHING AND DRYING.—"As soon as possible after digging, take the roots to some running stream to be washed. If there is no running stream convenient, it can be done at a pump. Take large, round sieves, two and a half or three feet in diameter, with the wire about as fine as wheat sieves; or if these cannot be had, get from a hardware store sufficient screen wire of the right fineness, and make frames or boxes about two and a half feet long and the width of the wire, on the bottom of which nail the wire. In these sieves or boxes, put half a bushel of roots at a time, and stir them about in the water, pulling the bunches apart so as

to wash them clean; then, having a platform at hand, lay them on it to dry. (To make the platform, take two or three common boards, so as to be about four feet in width, and nail cleets across the under side.) On these spread the roots about two inches thick, for drying in the sun. Carry the platforms to a convenient place, not far from the house, and place them side by side, in rows east and west, and with their ends north and south, leaving room to walk between the rows. Elevate the south ends of the platforms about eighteen inches, and the north ends about six inches from the ground, putting poles or sticks to support them; this will greatly facilitate drying. After the second or third day's drying, the madder must be protected from the dews at night, and from rain, placing the platforms one upon another, to a convenient height, and covering the uppermost one with boards. Spread them out again in the morning, or as soon as the danger is over. Five or six days of ordinarily fine weather will dry the madder sufficiently, when it may be put away till it is convenient to kiln-dry and grind it.

KILN-DRYING.—"The size and mode of constructing the kiln may be varied to suit circumstances. The following is a very cheap plan, and sufficient to dry one ton of roots at a time. Place four strong posts in the ground, twelve feet apart one way, and eighteen the other; the front two fourteen feet high, and the others eighteen; put girts across the bottom, middle and top; and nail boards perpendicularly on the outside as for a common barn. The boards must be well seasoned, and all cracks or holes should be plastered or otherwise stopped up. Make a shed roof of common boards. In the inside put upright standards about five feet apart, with cross pieces, to support the scaffolding. The first cross pieces to be four feet from the floor; the next two feet higher, and so on to the top. On these cross pieces lay small poles about six feet long and two inches thick, four or five inches apart. On these scaffolds the madder is to be spread nine inches thick. A floor is laid at the bottom, to keep all dry and clean. When the kiln is filled, take six or eight small kettles or hand

furnaces, and place them four or five feet apart on the floor, (first securing it from fire with bricks or stones,) and make fires in them with charcoal, being careful not to make any of the fires so large as to scorch the madder over them. A person must be in constant attendance to watch and replenish the fires. The heat will ascend through the whole, and in ten or twelve hours it will all be sufficiently dried, which is known by its becoming brittle like pipe-stems.

Breaking and Grinding.—"Immediately after being dried, the madder must be taken to the barn and threshed with flails, or broken by machinery, (a mill might easily be constructed for this purpose,) so that it will feed in a common grist mill. If it is not broken and ground immediately, it will gather dampness so as to prevent its grinding freely. Any common grist mill can grind madder properly. When ground finely it is fit for use, and may be packed in barrels like flour, for market."

Mr. Swift, of Ohio, has raised 2,000 barrels per acre in one crop of four years' growth, at a net profit, including all charges of rent, etc., of $200 per acre. The roots of madder are also a good food for cattle, but the expense and delay of producing it, unfit it for this use among us.

WOAD, (ISATIS TINCTORIA,)

Is considerably used in this country for dyeing, and generally as a base for blues, blacks and some other colors, and for these it supplies the place of indigo. There are several varieties of woad, but the common biennial plant is the only one cultivated. Loudon says:

"The Soil for woad should be deep and perfectly fresh, such as those of the rich, mellow, loamy, and deep vegetable kind. Where this culture is carried to a considerable degree of perfection, the deep, rich, putrid, alluvial soils on the flat tracts extending upon the borders of the large rivers, are chiefly employed for the growth of this sort of crop; and it has been shown by repeated trials that it answers most perfectly when they are broken up for it immediately from a state of sward.

"*The preparation of the soil*, when woad is to be grown on grass land, may either be effected by deep plowings, with the aid of the winter's frost, cross plowing and harrowing in spring; by paring and burning; or by trench plowing, or spade trenching. The first mode appears the worst, as it is next to impossible to reduce old turf in one year, and, even if this is done, the danger from the grub and wire worm is a sufficient argument against it. By plowing deep in February, and soon afterwards sowing, the plants may germinate before the grub is able to rise to the surface; by trench plowing, the same purpose will be better attained; and, best of all, by spade trenching. But a method equally effectual with the first, more expeditious, and more destructive to grubs, insects, and other vermin, which are apt to feed on the plants in their early growth, is that of paring and burning. This is, however, chiefly practiced where the sward is rough and abounds with rushes, sedge, and other plants of the coarse kind, but it might be had recourse to on others, with benefit.

"THE MODE OF SOWING is generally broadcast, but the plant might be most advantageously grown in rows and cultivated with the horse hoe. The rows may be nine inches or a foot apart, and the seed deposited two inches deep. The quantity of seed for the broadcast method is five or six pounds to the acre; for the drill mode, two pounds are more than sufficient, the seed being smaller than that of the turnip. New seed, where it can be procured, should always be sown in preference to old; but, when of the latter kind, it should be steeped for sometime before it is put into the ground. The time of sowing may be extended from February to July. Early sowing, however, is to be preferred, as in that case the plants come up stronger, and afford more produce the first season. The after culture of the woad consists in hoeing, thinning, prong-stirring, and weeding, which operations may be practiced by hand or horse tools, as in the culture of teazel.

GATHERING THE CROPS.—"The leaves of the spring sown plants will generally be ready towards the latter end of June or beginning of July, according to the nature of the soil, season and

climate; the leaves of those put in at a later period in the summer are often fit to be gathered earlier. This business should, however, constantly be executed as soon as the leaves are fully grown, while they retain their perfect green color, and are highly succulent; as when they are let remain till they begin to turn pale, much of their goodness is said to be expended, and they become less in quantity, and of an inferior quality for the purposes of the dyer. Where the lands are well managed, they will often afford two or three gatherings, but the best cultivators seldom take more than two, which are sometimes mixed together in the manufacturing. It is necessary that the after-croppings, when they are taken, should be constantly kept separate from the others, as they would injure the whole if blended, and considerably diminish the value of the produce. It is said that the best method, where a third cropping is either wholly or partially made, is to keep it separate, forming it into an inferior kind of woad. In the execution of this sort of business, a number of baskets are usually provided in proportion to the extent of the crop, and into these the leaves are thrown as they are taken from the plants. The leaves are detached from the plants, by grasping them firmly with the hand, and giving them a sort of sudden twist. In favorable seasons, where the soils are rich, the plants will often rise to the height of eight or ten inches; but in other circumstances, they seldom attain more than four or five.

"The produce is mostly from about a ton to a ton and a half of green leaves. The price varies considerable; but for woad of the prime quality, it is often from $125 to $150 per ton, and for that of an inferior quality $30 or $35, and sometimes much more.

"To prepare it for the dyer, it is bruised by machinery to express the watery part; it is afterwards formed into balls and fermented, re-ground, and fermented in vats, where it is evaporated into cakes in the manner of indigo. The haulm is burned for manure or spread over the straw-yard, to be fermented along with straw dung. To save seed, leave some of the plants undenuded of their leaves the second year, and when it is ripe, in July or

August, treat it like turnip seed. The only diseases to which the woad is liable, are the mildew and rust. When young it is often attacked by the fly, and the ground obliged to be re-sown, and this more than once even on winter-plowed grass lands."

WELD OR DYERS' WEED, (RESEDA LUTEOLA.)

Weld is much used by the manufacturers of various fabrics as a dye. It has not to our knowledge been cultivated in this country. We again quote from Loudon: "Weld is an imperfect biennial, with small fusiform roots, and a leafy stem from one to three feet in height. It is a native of Britain, flowers in June and July, and ripens its seeds in August and September. Its culture may be considered the same as that of woad, only being a smaller plant it is not thinned out to so great a distance. It has this advantage for the farmer over all other coloring plants, that it only requires to be taken up and dried, when it is fit for the dyer. It is, however, an exhausting crop.

"Weld will grow on any soil, but fertile loams produce the best crops. The soil being brought to a fine tilth, the seed is sown in April or the beginning of May, generally broadcast. The quantity of seed is from two quarts to a gallon per acre, and it should either be fresh, or, if two or three years old, steeped a few days in water previously to being sown. Being a biennial, and no advantage obtained from it the first year, it is sometimes sown with grain crops in the manner of clover, which, when the soil is in a very rich state, may answer, provided that hoeing, weeding and stirring take place as soon as the grain crop is cut. The best crops, however, will obviously be the result of drilling and cultivating the crop alone. The drills may be a foot asunder, and the plants thinned to six inches in the row. In the broadcast mode, it is usual to thin them to six or eight inches' distance every way. Often, when weld succeeds grain crops, it is never either thinned, weeded or hoed, but left to itself till the plants are in full blossom.

"THE CROP IS TAKEN by pulling up the entire plant; and the proper period for this purpose is when the bloom has been pro-

duced the whole length of the stems, and the plants are just beginning to turn of a light or yellowish color; as in the beginning or middle of July in the second year. The plants are usually from one foot to two feet and a half in height. It is thought by some advantageous to pull it rather early, without waiting for the ripening of the seeds; as by this means there will not only be the greatest proportion of dye, but the land will be left at liberty for the reception of a crop of wheat or turnips; in this case, a small part must be left solely for the purpose of seed. In the execution of the work, the plants are drawn up by the roots in small handfuls; and after each handful has been tied up with one of the stalks, they are set up in fours in an erect position, and left to dry. Sometimes, however, they become sufficiently dry by turning without being set up. After they have remained till fully dry, which is mostly effected in the course of a week or two, they are bound up into larger bundles, each containing sixty handfuls, and weighing fifty-six pounds. Sixty of these bundles constitute a load, and in places where this kind of crop is much grown, are tied up by a string made for the purpose, which is sold under the title of weld-cord.

"THE PRODUCE OF WELD depends much on the nature of the season; but from half a load to a load and a half per acre is the quantity most commonly afforded. It is usually sold to the dyers at from five or six to ten or twelve pounds the load, and sometimes at considerable more. It is mostly bought by persons who afterwards dispose of it to the dyers. The demand for it is sometimes very little, while at others it is so great as to raise the price to a high degree. It is sometimes gathered green and treated like woad or indigo; but in general the dried herb is used by the dyers in a state of decoction.

"THE USE OF WELD in dyeing is for giving a yellow color to cotton, woolen, mohair, silk and linen. Blue cloths are dipped in a decoction of it, which renders them green; and the yellow color of the paint called Dutch pink is obtained from weld. To save seed, select a few of the largest and healthiest plants, and

leave them to ripen. The seed is easily separated. The chief disease of weld is the mildew, to which it is very liable when young, and this is the reason that it is often sown with other crops."

SUMACH, (RHUS GLABRUM, R. CORIARIA AND R. COTINUS.)

The *Rhus Glabrum* is the common sumach of the United States which grows spontaneously on fertile soils. It is considerably used by dyers, and the tanners of light leather. It is, however, much inferior to the *R. Coriara* or Sicilian sumach, which is imported into this country from Spain, Portugal, Sicily, Syria and elsewhere, and sells at from $50 to $120 per ton. It is a dwarf, bushy shrub, smaller than the American, but with much larger leaves. These with the seed cones and young stems are all used by the manufacturers. The *R. Cotinus* or Venice sumach, is the fringe tree or burning bush, a shrub for ornamental grounds, bearing a flossy, drab colored blossom. It is known in England as young fustic, and is much used in the arts. This has not been as yet, an article of much production in the United States, but we see no good reason why it may not be introduced into many localities with decided profit.

CULTIVATION AND TREATMENT.—All the sumachs are propagated by layers, though it is probable they might, under favorable circumstances, be raised from the seed. On good soils they grow in great profusion. The harvesting consists simply in cutting off the young branches with the leaves and seed cones attached, in clear weather, drying them thoroughly without exposure to either rain or dew, and packing them in bales of about 160 pounds for market.

The sumach is highly astringent, often taking the place of galls. This quality is much enhanced by warmth of climate; and the most valuable article is brought from the most southern regions. There is no doubt this species of plants might be cultivated with great profit in the Southern States, and thus save the large amount annually expended in its importation, which is constantly increas-

ing. The total importation is now estimated at between one and two millions of dollars per annum.

THE TEASEL OR FULLER'S THISTLE, (DIPSACUS FULLONUM,)

Is another article exclusively used by the manufacturers for the purpose of raising a nap, or combing out the fibres upon the dressed surface of woolen cloth or flannels. The consumption cannot of course be extensive, being limited exclusively to this demand. There is but one kind cultivated. A bastard variety of spontaneous growth exists in portions of our Middle States which resembles the useful teasel, with this peculiar difference, that the ends of the awns or chaff on the heads are straight instead of hooked, which renders them perfectly useless.

Cultivation.—The teasel is a biennial, requiring two years to mature. It is sown on a deep loamy clay, previously well plowed and harrowed, in drills twenty inches asunder, leaving a plant in every ten inches, or in hills about sixteen inches apart. The ground should be kept light by occasional stirring, and free from weeds. The plants are generally stronger and more thrifty if allowed to mature where sown, and to accomplish this, the intermediate spaces between the hills may be annually planted with new seed. Many adopt the plan of sowing in beds and transplanting. Although hardy, there is sometimes an advantage in covering the beds which contain the young plants with straw during the winter.

Gathering.—Those intended for use should be cut with a stem eight inches long below the head, just as it is going out of flower, when the awns are the toughest; and as these come into maturity at different times in the same plant, they should be cut successively as they come forward. Those intended for seed, which should always be the largest, strongest heads, must be suffered to remain till ripe, when they can be gathered and threshed with the flail. The others should be thinly spread and dried under cover where no moisture can reach them. They may then be assorted into three parcels, according to size and quality,

and packed in large sacks, when they are ready for market. The crop on good soils well cultivated, may be stated at 150,000 to 200,000 per acre, worth from $1.50 to $2.50 per 1,000.

MUSTARD.

There are two species of mustard used for field cultivation; *the white*, (*Sinapis alba*,) and *the black*, (*S. nigra*,) the last of which is generally raised. It requires a rich loamy soil, deeply plowed and well harrowed. It may be sown, either broadcast, in drills about two feet apart, or in hills. Mr. Parmelee, of Ohio, thus raised on twenty-seven acres, 23,850 pounds, which brought in the Philadelphia market, $2,908; an average of over $100 per acre. The ground on which it is planted must be frequently stirred, and kept clear of weeds. When matured, it should be carefully cut with the scythe or sickle, and if so ripe as to shell, laid into a wagon box with tight canvas over the bottom and sides, so as to prevent waste. As soon as it is perfectly dry, it may be threshed and cleaned, when it is ready for market.

The mustard is a valuable crop for green food for cattle or sheep, or for plowing in as a fertilizer. The following experiment was made by Mr. Gray, in England, in 1844, an account of which appears in the Journal of the Royal Agricultural Society. He says: "The land on which it is growing is a thin stone-brash, and very poor. It had been manured for turnips and rape, at the rate of thirty loads an acre, with compost, consisting of two-thirds lime and one-third road earth; and, on the tenth of July, the turnip and rape seed were drilled in with eighty bushels of ashes an acre. It came up slowly; and, with very few exceptions, was taken off by the fly. On the twenty-eighth of August, I sowed twelve pounds of *white* mustard seed an acre, harrowing in the same. It was slow in coming up, from the dryness of the land; indeed, at one time I despaired of a crop, but when the rain fell it grew prodigiously; and on the eleventh day of October I commenced feeding it. On an average it was then two feet high, and very thick in the ground; you will judge, from the specimen

sent, of its present height—above thirty inches. I consider it a valuable artificial in sheep husbandry, and particularly so when turnips or rape fail; and, from its rapid growth, two, or even three crops may be taken and fed off in the season. From its great succulency, some care is required in feeding it off. Our sheep are doing well upon it; but I find they make better work, having an outlet every day on their walk, than when they were wholly confined upon it. Four hundred consume about a quarter of an acre a day, or thereabouts. One man grew a most excellent piece of mustard last autumn, on some very heavy clay land, and without manure. His sheep being badly managed when feeding it off, he plowed in a considerable quantity for his wheat, of which he had a splendid crop, and certainly the best he grew last season. I mention this circumstance, believing it may be grown with success on either heavy or light soils. I was led to suppose it might be greatly affected by frosts, but we have experienced sufficient to destroy the potato haulm and the dahlias, yet it has not in the slightest degree affected the mustard; I, therefore, conclude it must be severe to destroy it. The seed cost 14*s.* 6*d.* (about $3.65) per bushel, and weighed about fifty pounds."

THE HOP, (HUMULUS LUPULUS,)

Of which there are several varieties indigenous to this country, is an important field crop. It grows best on a strong loam or well drained clay with a light subsoil. If the latter be retentive of water, the hop will soon dwindle or die out. If made sufficiently rich, it will flourish on light loams or gravels, but a new, strong soil is better, and this requires little or no manure. The most desirable exposure is a gentle slope to the south, but this should be where it can have a free circulation of air amidst the tall, luxuriant, vegetable growth.

Cultivation.—If the land has been long in use, it should be thoroughly dressed with compost and alkaline manures, or what is nearly equivalent, with fresh barn-yard manures, on a previously well hoed crop, made perfectly free of all weeds, and

deeply plowed and harrowed. Then mark out the ground at intervals of six feet each way, and plant in the intersection of the furrows, and unless the ground be sufficiently rich, place three or four shovels of compost in each hill. The planting is done with the new roots taken from the old hills, which are laid bare by the plow. Each root should be six or eight inches long and must contain two or more eyes, one to form the root and the other the vine. Six plants are put in a hill, all of which should be within the compass of about a foot, and covered to a depth of five inches, leaving the ground level when planted. The first season, the intermediate spaces between the hills may be planted with corn or potatoes, and the ground should be carefully cleared of weeds and frequently stirred. No poles are necessary the first year, as the product will not repay. The ground should receive a heavy dressing of compost the following spring, if not sufficiently rich, and the plants should be well hoed and kept clean.

Poles may be prepared at the rate of two or three to each hill, twelve to sixteen feet long, according to the strength of the soil in which the hops are planted—the stronger the soil, the longer the poles—and selected from a straight, smooth, undergrowth of tough, durable wood, from four to five inches diameter at the butt end. Cedar, or tamarac, (larch,) are the best, lightest, and most durable. These are sharpened and firmly set with an iron bar, or socket bar with a wooden handle, in such a position as will allow the fullest effect of the sun upon the hills or roots. When the plants have run to the length of three or four feet in the spring, they should be trained around the poles, winding in the direction of the sun's course, and fastened below the second or third set of leaves, where there is sufficient strength of vine to sustain themselves. They may be confined with rushes, tough grass, or more easily with woolen yarn. This operation is needed again in a few days, to secure such as may have got loose by the winds or other causes, and to train up the new shoots.

A recent method has been adopted of making trellises from pole to pole of strong twine—one pole to the hill—three or four

twisted twines stretching from one pole to the other in rows. This is a more laborious process than to use double poles to the hill, but the gross amount of expense may be lessened by the process.

THE GATHERING of hops should be when they have acquired a strong scent, at which time the seed becomes firm and brown, and the lowest leaves begin to change color. This precedes the frosts in September. The vines must first be cut at the surface of the ground, and the poles pulled up and laid in convenient piles, when they may be stripped of the hops, which are thrown into large, light baskets. Or the poles may be laid on long, slender boxes, with handles at each end, (to admit of being carried by two persons,) and as the hops are stripped, they fall into the box. But care must be taken that they be free from leaves, stems, and dirt.

The hops should be hilled or covered with compost, and all the vines removed in the fall. The following spring, when the ground is dry, the surface is scraped from the hill, or additional compost is added, when a plow is run on four sides as near as possible without injury to the plants. All the running roots are laid bare and cut with a sharp knife within two or three inches of the main root, and the latter are trimmed, if spreading too far. It is well to break or twist down the first shoots, and allow those which succeed to run, as they are likely to be more productive. Cutting should be avoided unless in a sunny day, as the profuse bleeding injures them. The poles will keep longer under cover.

CURING OR DRYING.—This is an important operation, and it may be done by spreading the hops thinly in the shade and stirring them often enough to prevent heating. But when there is a large quantity, they can only be safely cured in a kiln. The following mode is recommended by Mr. Blanchard, in the New England States:

"Much depends on having a well constructed kiln. For the convenience of putting the hops on the kiln, the side of a hill is

generally chosen for its situation. Care should be taken that it be a dry situation. The kiln should be dug out the same bigness at the bottom as at the top; the side walls laid up perpendicularly, and filled in solid with stone, to give it a tunnel form. Twelve feet square at the top, two feet square at the bottom, and at least eight feet deep, is deemed a convenient size. On the top of the walls, sills are laid, having joists let into them in like manner as for laying a floor, on which laths, about one and a half inches wide are nailed, leaving open spaces between them three-fourths of an inch, over which a thin linen cloth is spread and nailed at the edges to the sills. A board about twelve inches wide is set up on each side of the kiln, on the inner edge of the sill, to form a bin to receive the hops. The larger the stones made use of in the construction of the kiln, the better; as it will give a more steady and dense heat. The inside of the kiln should be plastered with mortar to make it completely air tight. Charcoal (that made from yellow birch or maple I should prefer,) is the only fuel proper to be used in drying hops. The kiln should be well heated before any hops are put on, and carefully attended, to keep a steady and regular heat. Fifty pounds of hops, when dried, is the largest quantity that should be dried at one time, on a kiln of this size; and unless absolutely necessary to put on that quantity, a less would dry better. The green hops should be spread as evenly and as light as possible over the kiln. The fire at first should be moderate, but it may be increased as the hops dry and the steam is evaporated. The hops, after laying a few days, will gather a partial moisture, called a sweat. The sweat will probably begin to subside in about eight days, at which time, and before the sweat is off, they ought to be bagged in clear, dry weather.

"As the exact time when the hops will begin to sweat, and when the sweat will begin to subside or dry off, (the proper time to bag them,) will vary with the state of the atmosphere, it will be necessary to examine the hops from day to day, which is easily done by taking some of them from the center of the heap with

your hand. If on examination you find the hops to be very damp, and their color altering, which will be the case if they were not completely dried on the kiln, and not otherwise, you must overhaul them and dry them in the air. Hops should not remain long in the bin or bag after they are picked, as they will very soon heat and become insipid. The hops should *not* be stirred on the kiln until they are completely and fully dried. Then they should be removed from the kiln into a dry room, and laid in a heap, and there remain, unmoved and unstirred, until bagged, which is done with a screw, having a box made of plank, the size the bag is wished, into which the cloth is laid, and the hops screwed into the box, which is so constructed that the sides may be removed and the bag sewed together while in the press. The most convenient size for a bag of hops, to handle and transport, is about five feet in length, and to contain about two hundred and fifty pounds. The best bagging is coarse, strong, tow cloth, of our domestic manufacturing; next to that, Russia hemp bagging.

"It is now common for those who have entered considerably into the cultivation of hops, to build houses over their kilns, which, in wet weather, are very convenient; otherwise, a kiln in the open air would be preferable. It is necessary to have these buildings well ventilated with doors and windows, and to have them kept open night and day, except in wet weather, and then shut those only which are necessary to keep out the rain. If a ventilator was put in the roof of the building, directly over the center of the kiln, about six feet square, built like those in breweries and distilleries, they would be found very advantageous. I have seen many lots of hops much injured both in color and flavor, by being dried in close buildings. Where the houses over the kilns are built large, for the purpose of storing the hops as they are dried, which is a great saving of labor, a close partition should be made between the kilns and the room in which the hops are stored, to prevent the damp steam from the kilns coming to them, as it will color them, and injure their flavor and quality very much."

The foregoing account states fairly the *principle* on which hops should be dried. Since that was written, improved kilns have been invented and brought into use.

DISEASES.—Hops are liable to attack from various insects, blight, mildew, etc. There is no effective remedy of general application for either. The best preventives are new or fresh soil, which is rich in ashes and the inorganic manures, and in a fine tillable condition to insure a rapid growth, by which it may partially defy attack, and open planting on such positions as will secure free circulation of air. When properly managed they are one of the most productive crops, and their increasing use will always make them a large object of cultivation.

Hops are now so extensively grown in some parts of the country that treatises have been written and published on their culture, curing, and packing, which we recommend the cultivators to obtain.

THE CASTOR BEAN, (RICINUS COMMUNIS, COMMONLY CALLED PALMA CHRISTI,)

Is a native of the West India Islands, where it grows with great luxuriance. It is cultivated as a field crop in our lower Middle States, and in the States bordering the Ohio river on the north. It likes a rich, mellow bed, and is planted and hoed like corn. It attains the height of five or six feet, and bears at the rate of twenty to thirty bushels per acre. The seed is separated from the pods, bruised and subjected to a great pressure, by which they yield near a gallon to the bushel of *cold pressed* castor oil, which is better than that extracted by boiling and skimming. The last is done either with or without first slightly roasting. This oil forms not only a mild cathartic, but with some, is an article of food. Its separation into a limpid oil for machinery and lamps, and into stearine for candles, has lately much increased its valuable uses; but with the spontaneous flows of mineral oils now so plentifully produced with us, the use of castor oil will be chiefly confined to medicinal uses.

CHAPTER XII.

AIDS AND OBJECTS OF AGRICULTURE.

We have thus far treated of soils and manures, the preparation of the ground, and the ordinary cultivated field crops, as fully as our limits will permit. It remains for us briefly to add such incidental aids and objects of agriculture, as could not appropriately be embraced under either of the foregoing heads.

ROTATION OF CROPS, ITS USES AND EFFECTS.

The practice of rotation of crops, is an agricultural improvement of very modern date. It is first mentioned in Dickson's "Treatise on Agriculture," published in Edinburgh in 1777. Rotation has, for more than a century, been partially practiced in Flanders, and perhaps in some other highly cultivated countries, and it was afterwards introduced and imperfectly carried out, on a limited scale, in the Norfolk district in Great Britain, but its general introduction did not take place till the beginning of the present century. The system of rotation is one of the first and most important principles of general husbandry, and it cannot be omitted without manifest disadvantage and loss. The place of rotation was formerly supplied by *naked fallows.* This practice consists, as we have before shown, in giving the soil an occasional or periodical *rest*, in which no crop is taken off, and the soil is allowed to produce just what it pleases, or nothing at all, for one or more years, when it is refreshed and invigorated for the production of its accustomed useful crops. This system, it will be perceived, implies the loss of the income of the soil for a certain portion of the time, and it can be tolerated only where there is more land than can be cultivated. Modern agricultural science

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has detected, in part at least, the true theory of the necessity for rotation. It has been discovered that every crop robs the soil of a portion of its elements, (fifteen or sixteen elementary substances combined in various forms and proportions,) and that no two dissimilar crops abstract these elements or their compounds from the soil in the same proportions. Thus, if we consider the amount of the salts taken out of the soil by a crop of turnips, amounting to five tons of roots per acre; of barley, thirty-eight bushels; one ton each of dry clover or rye grass; and of wheat, twenty-five bushels, we shall find the great disproportions of the various elements, which the different vegetables have appropriated. As given by Johnston, they will be in pounds as follows:

	Turnip. Roots.	Barley. Grain.	Barley. Straw.	Red. Clover.	Rye. Grass.	Wheat. Grain.	Wheat. Straw.	Total.
Potash, ...	145.5	5.6	4.5	45.0	28.5	3.3	0.6	233.0
Soda, ...	64.3	5.8	1.1	12.0	9.0	3.5	0.9	96.6
Lime, ...	45.8	2.1	12.9	63.0	16.5	1.5	7.2	149.0
Magnesia, . .	15.5	3.6	1.8	7.5	2.0	1.5	1.0	32.9
Alumina, ...	2.2	0.5	3.4	0.3	0.8	0.4	2.7	10.3
Silica, ...	23.6	23.6	90.0	8.0	62.0	6.0	86.0	299.2
Sulphuric Acid, . .	49.0	1.2	2.8	10.0	8.0	0.8	1.0	72.8
Phosphoric Acid, .	22.4	4.2	3.7	15.0	0.6	0.6	5.0	51.5
Chlorine, ...	14.5	0.4	1.5	8.0	0.1	0.2	0.9	25.6
								970.9*

Besides the elements above noted, all crops contain oxide of iron, and nearly all oxide of manganese and iodine; and of the organic elements associated in various combinations, they appropriate about ninety-seven per cent. of their entire dried weight. Now it is not only necessary that all the above materials exist in the soil, *but that they are also to be found in a form precisely adapted to the wants of the growing plant.* That they exist in every soil, in some conditions, to an amount large enough to afford the quantity required by the crop, can hardly be doubted, but that they are all in a form to supply the full demand of a luxuriant crop, is probably true of such only as are found, under favorable circumstances of season and climate, to have produced the largest burthens. If a succession of any given crops are

* This is exclusive of the turnip tops.

gathered and carried off the land, without the occasional addition of manures, they will be found gradually to diminish in quantity, till they reach a point when they will scarcely pay the expenses of cultivation. We mean to be understood as affirming this of all crops and all soils, however naturally fertile the latter may be, unless they are such as receive an annual or occasional dressing from the overflow of enriching floods, or are artificially irrigated with water, which holds the necessary fertilizing matters in solution; and such are not exceptions, but receive their manure in another form, unaided by the hand of the husbandman.

Neither are *old meadows* (mowing lands filled with the natural or uncultivated grasses, or whatever of useful forage they choose to bear,) exceptions to this rule, for though they may part with a portion of their annual crop in the hay, which is removed, and which is not returned as manure, and by a partial rest or pasturage appear to sustain their original fertility, yet if the true character of the various plants which they produce were accurately observed, (all of which are indiscriminately embraced under the general head of grass or hay,) it would be found that the plants gradually change from year to year; and while some predominate in one season, others take their place the year succeeding, and these again are supplanted by others in an unceasing round of natural rotation.

Another illustration of rotation may be observed in the succession of forest trees that shoot up on the same soil, to supply the places of such of their predecessors as have decayed or been cut down. Thus the pine and other of the coniferæ, are frequently found to usurp the place of the oak, chestnut, and other deciduous trees. This occurs sometimes partially, but in repeated instances which have come within our notice, forests have been observed to pass entirely from one order of the vegetable creation to its remote opposite, the seeds or germs of which, (the product of an ancient rotation,) had been lying dormant for centuries, perhaps, waiting a favorable condition of circumstances and soil to spring into life.

Many choice secondary bottom lands, and others munificently supplied by nature with all the materials of fertility, have by a long succession of crops been reduced to a condition of comparative sterility. Yet it will have been found in the progress of this exhaustion, that after the soil ceased to give an adequate return of one crop, as of wheat, corn, or tobacco, it would still yield largely of some other genus which was adapted to it. These lands, when thus reduced and turned out to commons for a few years, will again give crops much larger than those which closed their former bearing career, proving that nature has been silently at work in renovating the land for further use. The whole course of her operations is not yet known, but this much is satisfactorily ascertained, that she is incessantly engaged in producing those changes in the soil, which enable it to contribute to vegetable sustenance. Enough of lime, or potash, or silica, may have been disengaged to yield all that may be required for one crop, which by that crop is principally taken up, and if another of the same kind follows in quick succession, there will be a deficiency; yet if a different crop succeed, there may be found enough of all the materials it needs, fully to mature it. A third now takes its place, demanding materials for nutrition in forms and proportions unlike either which has preceded it, and by the time a recurrence to the first is necessary, the soil may be in a condition again to yield a remunerating return. These remarks apply equally to such soils as have, and such as have not received manures; unless, as is seldom the case, an accurate science should add them in quantity and character, fully to supply the exhaustion. The addition or withholding of manures, only accelerates or retards this effect.

Another prominent advantage of rotation, is in its enabling such crops to have the benefit of manure, as cannot receive it without hazard or injury if applied directly upon them. Thus wheat and the other white grains, are liable to overgrowth of straw, rust and mildew, if manured with recent dung; yet this is applied without risk to corn, roots, and most of the hoed crops;

and when tempered by one season's exhaustion, and the various changes and combinations which are effected in the soil, it safely ministers in profusion to all the wants of the smaller cereal grains.

A third benefit of rotation is, by bringing the land into hoed crops at proper intervals, it clears it of any troublesome weeds which may infest it. And still a further advantage may be found, in cutting off the appropriate food of insects and worms, which in the course of time, by having a full supply of their necessary aliment, and especially if undisturbed in their quiet haunts, will oftentimes become so numerous as seriously to interfere with the labors of the farmer. A change of crops, and exposure of the insects to frosts, and by the change of cultivation which a rotation insures, will make serious inroads upon their numbers, if it does not effectually destroy them.

The fanciful theory of the *noxious excretions of plants*, first broached, and ingeniously defended by the powerful name of Decandolle, and which the closest scrutiny of scientific observers since has pronounced unworthy of credit, does not form a fifth reason for rotation. It is because principals, essential to successful vegetation, have been abstracted, not that others hurtful to it have been added by preceding crops, that rotation is rendered necessary. From all that has hitherto been learned on the subject of rotation, either from science or practice, two general principles may be assumed as proper to guide every farmer in his course of cropping. First, to cultivate as great a variety of plants as his soil, circumstances and market will justify; and second, to have the same, or any similar species, follow each other at intervals as remote as may be consistent with his interests. From the foregoing observations on the subject, it is evident that the proper system of rotation for any farmer to adopt, must depend on all the conditions by which he is surrounded, and that it should vary according to these varying circumstances.

It is a practice with some to alternate wheat and clover, giving only one year to the former and one or two years to the latter.

This will answer for a long time, on soils adapted to each crop, provided there be added to the clover, such manures as contribute to its own growth, and such also as are exhausted by wheat. The saline manures, ashes, lime, etc., may be added directly to wheat without injury; but gypsum should be sown upon the clover, as its benefits are scarcely perceptible on wheat, while upon the clover, they are of the greatest utility. But there are objections even to this, as it does not allow an economical or advantageous use of barn-yard manures, which, from their combining all the elements of fertility, are the most certain in their general effect. In different countries of Europe, fields which have been used for an oft-recurring clover crop, have become *clover sick*, as it is familiarly termed. The plant will not grow luxuriantly; sometimes refusing to vegetate, or if it starts upon its vegetable existence, it does so apparently with the greatest reluctance and suffering, and ekes out a puny, thriftless career, unattended with a single advantage to its owner. This is simply the result of the exhaustion of one or more of the indispensable elements of the plant. If it be desirable to pursue this two course system for any length of time, nothing short of the application of all such inorganic matters as are taken up by the crops, will sustain the land in a fertile condition. We subjoin, simply for the purpose of illustration, and the guidance of such as may have little experience in rotation, some systems which have been pursued with advantage in this country:

1st. On a grass sod, broken up, with a heavy dressing of barnyard manure, and muck, ashes, and lime, if necessary. First year, corn, with gypsum scattered over the plants after the first hoeing, which should be immediately after its making its first appearance; second year, roots with manure; third year, wheat, if adapted to the soil; if not, then barley, rye, or oats, with grass or clover seed, or both; fourth year, meadow, which may be continued at pleasure, or till the grass or clover gives way. The meadow may be followed by pasturing if desired. Clover alone should not remain over two years as meadow, but for pasture it may be continued longer.

2d. First year, corn or roots on grass or clover lay, with manure; second, oats and clover, with a top dressing of ten to twenty bushels of crushed bones per acre; third, clover pastured to the last of June, then grown until fully matured in August, when it is turned over, and a light dressing of compost and forty to eighty bushels of leached ashes spread over it, and wheat and timothy seed sown about the fifteenth of September. If desired, the following spring, clover is sown and lightly harrowed. This gives for the fourth year, wheat; fifth and sixth, and if the grass continues good, the seventh year also, meadow.

3d. First, corn on a grass sod, heavily manured, and a half gill of ashes and gypsum, mixed at the rate of two of the former to one of the latter, put in the hill, and an equal quantity of pure gypsum added, after the corn is first hoed; second, oats or barley, with lime at the rate of twenty to thirty bushels per acre, sown broadcast after the oats, and harrowed in; third, peas or beans, removed early, and afterwards sown with wheat; fourth, wheat with a light top dressing of compost, and saline manures in the spring, and clover, or grass and clover seed; fifth, two or three years in meadow and pasture.

4th. First, wheat on a grass sod; second, clover; third, Indian corn, heavily manured; fourth, barley or oats, with grass or clover seed; fifth, and following, grass or clover.

5th. A good rotation for light, sandy lands, is first, corn well manured and cut off early and removed from the ground, which is immediately sown with rye, or the rye hoed in between the hill; second, rye with clover sown in the spring, and gypsum added when fairly up; third, clover cut for hay, or pastured, the latter being much more advantageous for the land.

WEEDS.

Whatever plants infest the farmer's grounds, and are worthless as objects of cultivation, are embraced under the general name of weeds. In a more comprehensive sense, all plants, however useful they may be as distinct or separate objects of attention, when

scattered through a crop of other useful plants, to their manifest detriment, may be considered and treated as such. Perfect cultivation consists in having nothing upon the ground but what is intended for the benefit of the farmer, and it implies a total destruction of every species of vegetation which does not contribute directly to his advantage.

In China, and some parts of Flanders, the fields are entirely free from weeds. This is the result of long continued cleanly cultivation by which every weed has been extirpated, a scrupulous attention to the purity of the seeds, and the sole use of urine, poudrette, and saline manures. This object is scarcely attainable in this country, except on fields peculiarly situated. The principal causes of the propagation of weeds among us, is the negligent system of tillage, and the use of unfermented vegetable manures. By heating or decomposition, all the seeds incorporated in the manure heap are destroyed. But there is a great loss in applying manure thus changed, and having parted with large portions of its active, nutritive gases, unless protected by a thick covering of turf or vegetable mold. For many soils and crops, undecomposed manures are far the most valuable. But they should always be applied to the hoed crops, and such as will receive the attention of the farmer for the utter extinction of weeds. A single weed which is allowed to mature, may become 500 the following year, and 10,000 the year after. The cleansing of land from weeds, is almost the sole justification for naked fallows. When a large crop of them have by any means obtained possession of the ground, they ought to be turned into the soil with the plow before ripening their seed, and they thus become a means of enriching rather than of impoverishing the ground. Meadows which have become foul with useless plants, may be turned into pasture; and if there are plants which cattle and horses will not eat, let them first crop it closely, and then follow with sheep, which are much more indiscriminate in their choice of food, and consume many plants which are rejected by other animals. Whatever escapes the maw of sheep, should be extir-

pated by the hand or hoe before seeding. The utmost care, also, should be used in the selection of seed, and none sown but such as has been entirely freed from any foreign seeds.

The Canada thistle is the only weed which has taxed the ingenuity of vigilant farmers in effecting its removal. This is, however, within the power of every one who will bestow upon it a watchful attention for a single season. The plant should be allowed to attain nearly its full growth, or till it comes into flower, when it has drawn largely upon the vitality of its roots. If the patch be large, the plow should be used to turn every particle of the plant under the surface, and let the hoe or spade complete what has escaped the plow. If the patch be small, the hoe or spade should be used to cut off the crown of the root, and if in blossom, let the tops be burnt to prevent the possibility of any of the seeds ripening. As soon as the tops again make their appearance above ground, repeat the plowing or spading, and continue this till the middle of autumn, when the land will be free from them, and in fine condition to yield a crop of wheat. If they harbor in fences or walls, these should be removed, or the thistle followed to its roots, and kept constantly cut into the ground, when it will not long survive. We have found mowing off with a scythe, when in early flower, quite an effective mode of extirpating this troublesome pest. The difficulty or ease of extirpating this weed depends much on the composition of the soil in which they spring up. When the land is cultivated from year to year in hoed or sown crops, they are most difficult. In pastures and meadows they are less hurtful. On some grounds, newly cleared, they may come in myriads, from their light, feathery seeds, wafted by winds. In such cases, the best way is to sow grass seeds thickly, mow the crop, which is generally done when both grass and thistles are in bloom, and the latter will rapidly disappear with each successive mowing. Such has been our own experience.

RESTORING WORN OUT SOILS TO FERTILITY, AND FERTILIZING BARREN LANDS.

Reams of paper have been written and printed in our agricultural journals on this not yet exhausted subject, and much still remains to be known. We have vast tracts of vacant land in these United States which have long lain exhausted by the plow, from the effects of continuous cropping without the return of adequate manures to keep up their fertility. They are favored by climate, contiguity to seaboard markets, and other advantages which would render them, in a state of moderate fertility only, among the most desirable of all our agricultural lands. Deposits of marl, lime, and other fertilizing material lie embedded in close proximity to them, needing only the aid of enlightened enterprise and industry to restore them to their original power of production.

In other sections, extensive areas, once supposed to be incurably barren, await a like action to render them available for good farming. While richer soils in like situations, are worth, for farm purposes, fifty to two hundred dollars per acre, these barrens are comparatively worthless. On the good lands, the occupants and cultivators grow rich, while the poor are hardly worth the taxes paid upon them. Still, they are in no worse natural condition than large tracts of soil in Britain, and on the neighboring continent, two or three centuries ago; and but for the almost illimitable fertile soils extending over our Western States and Territories, more inviting to the emigrant, they would, ere this, have been brought into moderate, if not good fertility, and cultivated by a thriving population. Large commercial and manufacturing cities lie near them, consuming triple the amount of crops which under the best condition they might bear, and still they are measurably neglected. This can only be accounted for in the dislike of *poor land* so common to the native American, and the want of means in the foreign immigrant to our shores, who, having the knowledge of their properties, but wanting the means to pur-

chase and improve, passes them by for the new and virgin soils far away in the interior.

Yet, the worn out lands, long ago abandoned under a system of labor now forever passed, as well as the soils never yet reclaimed from their original barrenness, give indications of restoration and improvement which promise both reproduction in the one, and bringing into culture of the other. The plan of the American farmer has seemed to be to select a naturally good soil, plant himself upon it, and either by a careless mode of cropping, wear it out, and then abandon it for a better, and newer one, or by a course of good husbandry maintain it in its productive condition and transmit it to his heirs, if his restive disposi tion did not induce him to "better himself" by a sale, and remove to what he considered a more eligible home.

We can do no better service to our farmers, gardeners, and fruit growers, than to draw their attention to these either worn, or naturally barren lands, provided they have the means, and will intelligently select them and undertake their improvement. We say nothing of localities, having no private interest in any, but in a general way, only, refer to them. Some are better than others; some, possibly, incurably barren; but selections can be made to decided advantage by those who choose to enter on their cultivation. Fertilizers of almost every description abound in our country, either of native production, or which, at moderate prices, can be obtained from abroad. These, with the aid of green crops plowed in, as the clovers, buckwheat, green corn—the latter used to great advantage in many localities within our knowledge—even the common annual weeds, when not of too pestiferous character, will aid largely in bringing these lands into a state of fertility. In our discussion of animal and vegetable manures, the phosphates, and the various organic and inorganic materials applicable to such uses, no intelligent man need be at a loss for the means to make these lands available as permanent sources of profit.

We have, too, wide tracts of marshy land on our seaboard, as well as in interior localities, now comparatively worthless, which may be ditched, dyked, and drained to untold benefit. With us, little has yet been done to reclaim our seaboard marshes. During the past year, the tide-water lowlands lying between Jersey City and Newark, in the State of New Jersey, have been entered upon by an enterprising company for the purpose of dyking and drainage. These lands have hitherto yielded only moderate crops of salt grass, of little value. We trust this may prove a successful experiment. If so—and we see no good reason why it should not—it will be followed by other enterprises of the kind, extending along our wide-spread Atlantic shores, and reclaim an untold wealth of soil to our agricultural production in its most valuable localities. Extensive areas of swamp land, also, are scattered throughout our several states, awaiting only an intelligent expenditure of capital in the same direction, to render them among the most fertile, enduring, and desirable soils to the husbandman. Millions of acres, with much greater natural obstacles to encounter, have been reclaimed, and enclosed from the sea, and the broad estuaries of rivers in various parts of Europe, now embracing some of the most productive regions of the globe. And why should it not be so in America?

The subject is almost exhaustless, and we can only suggest these improvements—new creations of wealth, in reality—in general terms. Innumerable instances can be named where lands, even near many of our large cities, have already been rid of their myriads of forbidding boulders, and brought into the finest tilth and production; swamps, literally worthless, overgrown with bushes, coarse grass, good for nothing, and inhabited only by destructive vermin, or spreading miasma, and other pestilential exhalations over their neighborhoods, now yielding crops of the richest grasses; other once dismally barren tracts now yielding mountains of the finest vegetables, and the choicest fruits, for the support and luxury of the human family; all these we have seen accomplished within the time of a single generation; and why

should not such progress be indefinitely repeated? The subject commends itself to our industry, our public spirit, our patriotism, love of country, and humanity.

Look at England, Scotland, Ireland to a considerable extent, Belgium, Holland; neither of them, in their natural condition, equal to any given area in almost any portion of our Atlantic States. The main difference between those countries and ours, is, they had a redundant population within narrow limits, which *obliged* them to reclaim their waste lands, and we, Americans, have had all the fertile western world before us on which to spread, conquer, and ravage, with exhausting crops and heedless cultivation. It should not be so, or rather, it should not so remain. Without those wonder working feats of engineering skill and industry which have achieved our great canals and railways, our western crops would hardly be worth the harvesting, so distant are they from the seaboard markets. But speed and cheapness of transportation have overcome distance, and happily our far off cultivators and producers, by their timely aids, are brought into intimate connection with the consumers and exporters of their industry.

Those different soils, and their cultivation also, suggest divisions of agricultural labor into the products most favorable to them. The dairy, the grains—each in their own varieties—the grazing, the wool growing, the fruit bearing, the miscellaneous products, are each working into their own most available lands, instead of the old time ways of the farmer trying every thing, and producing scanty crops of many articles, with but a poor return for his labor. This mode of cultivation also produces a profitable interchange of commodities, one section with another, and each more favorable to his own chosen course of husbandry. The upshot of the whole matter is, the farmer should ascertain, as near to a certainty as possible what his land is best fitted for in a profitable crop or production, turn his chief attention to that and steadily pursue it with all the intelligence and vigor he may command. By such a course, and such a course only, can he expect to thrive. And this leads us to the subject of

EXPERIMENTS AMONG FARMERS.

The idea of "experiments" among farmers, has a very vague meaning, and has more often been a subject of ridicule with many of our practical men. It should not be so. We see no reason why farmers should not experiment in a reasonable way, as well as mechanics, chemists, or those of other useful professions.

A great advantage would result to agriculture if every intelligent farmer would pursue some systematic course of experiments, on such a scale and variety as his circumstances would justify, and give the results, if successful, to the community. It is with experiments in farming, as was said by Franklin, of a young man owning wild lands: "it is well enough for every one to have some, *if he don't have too many.*" They should be his servants, not his masters; and if intelligently managed and kept within due bounds, they may be made greatly subservient to his own interest, and, by their promulgation, eminently promotive of the general good. It is fully in accordance with another maxim of that wise head, that when it is not within our power to return a favor to our benefactor, it is our duty to confer one on the first necessitous person we meet, and thus the circle of good offices will pass round.

The mutual communication of improvements of any kind in agriculture, has the effect of benefiting not only the community generally, but even the authors themselves; as they frequently elicit corrections and modifications which materially enhance the value of the discovery. These experiments should embrace the whole subject of American agriculture; soils and their amelioration; manures of every kind, alkaline, vegetable and putrescent, and their effects on different soils and crops; plants of every variety, and their adaptation to different soils, under different circumstances and with various manures; and their relation to each other, both as successors in rotation, their value for conversion into animals and other forms, and their comparative ultimate profit; the production of new varieties by hybridizing and other-

wise; draining, both surface and covered; the improvements of implements and mechanical operations, etc., etc. They should also extend to the impartial and thorough trial of the different breeds of all domestic animals, making ultimate profit to the owner the sole test of their merits, crossing them in different ways and under such general rules as experience has determined as proper to be observed; their treatment, food, management, etc. Although much has been accomplished within the last few years, the science and practice of agriculture may yet be considered almost in its infancy. There is an unbounded field still open for exploration and research, in which the efforts of persevering genius may hereafter discover mines of immense value to the human family.

THE UTILITY OF BIRDS.

These are among the most useful of the farmer's aids, in securing his crops from insect depredation; and yet manifest as this is to every observing man, they are frequently pursued and hunted from the premises as if they were his worst enemies. The martin, the swallow and the wren, which may almost be considered among the domestics of the farm; and the sparrow, the robin, the bluebird, the woodpecker, the bob-o-link, the yellowbird, the thrush, the oriole, and nearly all the gay songsters of the field, accomplish more for the destruction of noxious flies, worms and insects, (the real enemies of the farmer,) than all the nostrums ever invented. And hence the folly of that absurd custom of scarecrows in cornfields and orchards, to which we have before alluded; and the chickens and ducks do the farmer more benefit than injury in the garden and pleasure grounds, if kept out of the way while the young plants are coming up. A troop of young turkeys in the field will destroy their weight in grasshoppers every three days, during their prevalence in summer. A pair of sparrows, while feeding their young, will consume 3,360 caterpillars in a week. One hundred crows will devour a ton and a half of grubs and insects in a season. Even the hawk and the owl, the objects of general

aversion, rid the fields and woods of innumerable squirrels, moles and field mice, which are frequently great depredators upon the crops, (after having exhausted the stores of worms and insects, which they first invariably devour,) and the smaller species when pressed by hunger, will even resort to grubs, beetles and grasshoppers, in the absence of larger game. (We mention the operations of the crows, hawks and owls simply *as a fact.* We have no love for either of them, being satisfied that they are more destructive to crops, and valuable domestic fowls, than in their consumption of insects and other vermin.) That loathsome monster, the bat, in its hobgoblin, murky flight, will destroy its bulk of flies in a single night. Slight injury may occasionally be done to the grain and fruit by the smaller birds, and when thus intrusive, some temporary precaution will suffice to prevent much loss. But whatever it may be, the balance of benefit to the farmer, from their presence, is generally in their favor, and instead of driving them from his grounds, he should encourage their social, chatty visits by kind and gentle treatment, and by providing trees and pleasant shrubbery for their accommodation.

Toads, Frogs, etc.—Shakspeare has said "*the toad*, ugly and venomous, wears yet a precious jewel in his head." Deducting the *venom*, we shall find the poet right; for we can no more attempt the defence of his beauty, than that of the muck heap; and we can well excuse his unprepossessing exterior, for the sake of the jewel which he wears in his tongue. This, like that of the chamelion, of which he is a cousin-german, he darts out with lightning rapidity, and clasps his worm or insect prey within its glutinous folds, which is with equal rapidity transformed to his capacious maw. Apparently dull, squat, and of the soil's hue, whatever that may be, he sits silent, meditative, yet watchful, in the thick shade of some overgrown cabbage, or other plant; and then as the careless insects buzz by, or the grub or beetle crawl along unheedful of danger, he loads his aldermanic carcass with the savory repast. Sixteen fresh beetles, a pile equal to his fasting bulk, have been found in the stomach of a single toad.

The frog, traipsing over the dewy fields, procures his summer subsistence in the same way as his seeming congener, the toad, and with equal benefit to the farmer.

FENCES.

In many countries which have been long under cultivation, with a dense population and little timber, as in China, and other parts of Asia, Italy, France, Belgium, Holland, and other parts of Europe, fences are seldom seen. In certain sections of the older settled portions of the New England States, also, a similar arrangement prevails. This is especially the case over the wide intervals or bottom lands which skirt the banks of the Connecticut and many other large rivers, where periodical inundations would annually sweep them away. Wherever this system is adopted, cultivation proceeds without obstruction, and a great saving is made not only in their original cost, but in the interest, repairs and renewal; all the land is available for crops; no weeds or bushes are permitted to send their annoying roots or scatter their seeds over the ground; no safe harbors are made for mice, rats or other vermin; the trouble and expense of keeping up bars or gates are avoided; and a free course is allowed by the conceded roads or by-paths, for the removal of the crops, and carrying on manures, and the necessary passing to and fro in their cultivation. These are important advantages, which it would be well for every community to consider and secure, to the full extent of their circumstances. The inconveniences of this arrangement are trifling. When cattle or sheep are pastured in Europe, where fences are wanting, they are placed under the guidance of a shepherd, who, with the aid of a well trained dog, will keep a large herd of animals in perfect subjection, within the prescribed limits. In the unfenced part of the Connecticut valley, (where extensive legislative powers reside in the separate towns, which enables each to adopt such regulations as best comport with their own interests,) no animals are permitted to go on to the fields till autumn, and the crops are required to be

removed at a designated time, when each occupant is at liberty to turn on to the common premises, a number of cattle proportionate to his standing forage, which is accurately ascertained by a supervisory board. A certain number of fences are necessary for such fields as are continued in pasture through the season, but, unfortunately, custom in this country has increased them beyond all necessity or reason. It rests with the farmers to abate such as they deem inconsistent with their interests.

The kind of fences should vary according to the controlling circumstances of the farm. In those situations where stone abounds, and especially if it is a nuisance, heavy stone fences, broad and high, are undoubtedly the most proper. Where these are not abundant, an economical fence may be constructed, by a substantial foundation of stone, reaching two or two and a half feet above ground, in which posts are placed, at proper distances, with two or three bar holes above the wall, in which an equal number of rails are inserted. Post and rail, and post and board fences are common where there is a deficiency of timber. The posts should be placed from two and a half to three feet below the surface, in the center of a large hole, and surrounded by fine stone, which should be well pounded down by a heavy iron-shod rammer, as they are filled in. The post will not stand as firmly at first as if surrounded by dirt, but it will last much longer. The lower end should be pointed, which prevents its heaving with the frost. If the position of the post, while in the tree, be reversed, or the upper end of the split section of the trunk which is used for a post, be placed in the earth, it will be more durable. Charring or partially burning the part of the post which is buried, will add to its duration. So, also, will imbedding it in ashes, lime, charcoal, or clay; or it may be bored at the surface with a large auger, diagonally downwards and nearly through, filled with salt and closely plugged. The best timber for posts, in the order of its durability, is red cedar, yellow locust, black walnut, white oak, and chestnut. We recently saw red cedar posts, used for a porch, which, we were

assured, had been standing exposed to the weather previous to the year 1770, and they were still perfectly sound. Two years ago, we took up about thirty old red cedar fence posts, which had stood forty-seven years in a compact clay soil, and all but three or four of them were perfectly sound, throughout. The avidity with which silicious sands and gravel act upon wood, renders a post fence expensive for such soils.

There are large portions of our country where timber abounds, especially in the uncleared parts of it, where the zig-zag, worm, or Virginia fence is by far the most economical. The timber is an incumbrance, and therefore costs nothing, and the rails can be cut and split to ten or twelve feet long for seventy-five cents to a dollar per hundred; and the hauling and placing is still less. With good rails, well laid up from the ground on stones or durable blocks, and properly crossed at the ends, and locked at the top, they are firm and durable. Staking the corners, by projecting rails, gives an unsightly appearance at all times, and is particularly objectionable for plowing, as it considerably increases the waste ground. The same object is obtained by locking the fence when completed, with a long rail on each side, one end resting on the ground and the other laid into the angle, in a line with the fence. More symmetry and neatness is secured, and a trifling amount of timber saved, by putting two small upright stakes, one on each side of the angle, and securing them by a white oak plank, six inches wide by eighteen inches long, with two holes of three inches diameter bored eight inches apart, and slipped over the posts, after most of the rails have been laid. Stout annealed wire, the size of No. 8 or 9, wrapped around each stake to hold them together, answers quite as well. An additional rail may be laid over it to keep the yokes, caps or wires in their place, and the whole is thus firmly bound together. In addition to the timber designated for posts, rails may be made from any kind of oak, black walnut, black and white ash, elm, and hickory.

Turf and clay fences have been tried in this country without success. Our frosts and rains are so severe as to break and

crumble them down continually. Cattle tread upon and gore them; and to swine and sheep they scarcely offer any resistance. *Wire fences* have been used to some extent, and if galvanized wire, which is not liable to rust, could be procured at a reasonable cost, it would combine gracefulness and utility in a high degree. *The hurdle*, or light movable fence, is variously formed, of cordage, wire, or wicker work, in short panels, and firmly set into the ground by sharpened stakes at the end of each panel, and these are fastened together. This is a convenient appendage to farms, where heavy green crops of clover, lucern, peas, turnips, etc., are required to be fed off in successive lots, by sheep, swine, or cattle. We have, within a few years past, seen several different samples of patent hurdle fence in use, which were quite effective for all kinds of the lighter farm stock. *The sunken fence*, or wall, is by far the most agreeable to good taste, and it is perfectly efficient. It consists of a vertical excavation on one side, about five feet in depth, against which a wall is built to the surface of the ground. The opposite side is inclined at such an angle as will preserve the sod, without sliding, from the effects of frost or rain, and is then turfed over. A farm thus divided, presents no obstruction to the view, while it is every where properly walled in, besides affording good ditches for the drainage of water. These sunken fences are sometimes raised a couple of feet above the ground, which increases the protection, at a less cost than deepening and widening the ditch.

Good fences, at all times kept in perfect repair, are the cheapest. Most of the unruly animals are taught their habits by their owners. Fences that are half down, or which will fall by the rubbing of cattle, will soon teach them to jump and throw down such as they are unable to overleap. For the same reason, gates are better than bars. When the last are used, they should be let down so near the ground that every animal can step over conveniently; nor should they be hurried over so fast as to induce any animal to jump. In driving a flock of sheep through them, the lower bars ought to be taken entirely out, or they be

allowed to go over the bars in single file. Animals will seldom become jumpers, except through their owner's fault, or from some bad example set them by unruly associates; and unless the fences be perfectly secure, these ought to be stalled until they can be disposed of. The farmer will find that no animal will repay him the trouble and cost of expensive fences and ruined crops.

Hedges have, from time immemorial, been used in Great Britain, and some parts of the European continent, but are now growing unpopular with utilitarian agriculturists. They occupy a great deal of ground, and harbor much vermin. A few only have been introduced in the old settled States of America, and they may never become great favorites there. For those disposed to try them, as a matter of taste or fancy, there are several kinds of our thorny, native shrubs that are both beautiful and hardy.

The subject of fences and hedging, in this country, has been much discussed in farm consultations within the last twenty years, and various opinions are entertained as to the necessity of their extent, and the material of which farm enclosures should be made, all depending much on the surface of the land, and the kinds of husbandry pursued. Where land is so plenty as in the United States, and large tracts, as in some of the States, lie out in commons—and frequently owned by non-residents—a wide latitude of custom prevails in letting animals range at large to graze upon them, particularly in the prairies. In many good farming districts, cattle are permitted to run in the highways. In the vicinity of growing towns, and villages, also, where many vacant lots are left unenclosed, cattle, swine, and geese, by common usage, although there may be general or local laws to the contrary, are permitted to run at large over them, and in the streets, greatly to the inconvenience of those who live within secure enclosures, while the streets in front of them are made a nuisance by these common trespassers, and so long as law is disregarded, and this annoying custom prevails, the subject of fences will remain one of extraordinary expense and difficulty.

As a rule, excepting the prairie regions, we have a great deal *too much* fencing in America. In many districts of country—the rough and hilly districts of New England for example,—the numerous stone walls that exist and have been built, at one time and another, cost more than the entire farms would now sell for. They were built, probably, partly to get rid of the surface stones on the fields, and partly because the owners of the farms thought at the time there was a necessity for them. So, also, it is the case with rail fences where fencing stones are not found.

A multiplicity of fences, either on a small or a large farm, are little better than a nuisance. In England, where hedges universally prevail, of late years they have been rooted out and thrown aside by thousands of miles in the aggregate. It should be so here, with stone walls and fences, as a great waste of good land will be saved by the process. Where fencing material is scarce and dear, excessive fencing will probably take care of itself. Road fencing is the most difficult wherever cattle run at large, and indeed these are the only fences of the farm, beyond those to enclose the buildings, which assume a permanent character, and demand a *lasting* material for their construction.

Hedges, for road fencing, are probably the best, if we can find the proper kinds of wood for the purpose. The English hawthorn, of which the English hedges are usually made, does not thrive in our cold, hot, and *drier* seasons. The leaves mildew badly in summer, and the wood is apt to freeze in winter. It has been often tried, and a failure has generally, as often been the result. The varieties of American thorn have also been tried, but with no very satisfactory results. The Osage orange has been extensively planted. Its chief objection thus far, has been its liability to winter kill in many northern localities. Yet it may surmount this tendency, and if so, it makes an effective hedge, being a strong grower, not succoring from the root, well thorned, and when well grown, sufficiently sturdy to resist any animal.

Other woods, as the three thorned acacia, or honey locust, the common white beech, some varieties of the willow, and evergreens

have been recommended, and tried, but as yet with no well established success. We think, the wild crab apple, and plum, provided they will bear such close growing and clipping, will prove among our best native woods for this purpose, as they are hardy, not over rampant growers, and durable. We are likely, however, to undergo a long series of trials, before a *universal* American hedge plant shall become established.

FARM ROADS.

Good roads in the interior of a farm of any considerable size are indispensable to facilitate the passage to and from the cultivated fields, or pastures, and aid in drawing all articles back and forth. These roads need not be expensive in construction, as they are not in daily use for vehicles, and farm stock require little accommodation beyond a simple roadway in passing over them. All roads of this kind should be so conveniently located as to approach the several fields readily, and made permanent in their structure, when once laid out.

It is not necessary that they be always fenced off from the adjoining fields. That must depend on the mode of farming adopted, whether it be in crop raising, or stock keeping. The surface of the land and the character of the soil will determine the necessity of throwing the pathway into a ridge, with side ditches, or not. Clayey or heavy muck lands will require them, for a permanently good road; free and loose soils will be well enough without that labor. Ten to twelve feet wide is space enough for the trackway, if the open ditches by the side are shallow enough to admit a turnout, when two vehicles meet, which is seldom the case inside of the farm. If it be necessary to fence the road into a lane, twenty to thirty feet is wide enough; otherwise, the track need only occupy a little more than the width of a cart or wagon.

SHADE TREES,

In such situations and numbers as may be required around the farm premises, are both ornamental and profitable. They have,

too, a social and moral influence, far beyond the mere gratification of the eye, or the consideration of dollars and cents. In their freshness and simplicity, they impress the young mind with sentiments of purity and loveliness as enduring as life. From the cradle of infancy, consciousness first dawns upon the beauty of nature beneath their grateful shade; the more boisterous sports of childhood seek their keenest enjoyment amid their expanded foliage; and they become the favorite trysting place when the feelings assume a graver hue, and the sentiment of approaching manhood usurp the place of unthinking frolic. Their memory in after life greets the lonely wanderer amid his trials and vicissitudes, inciting him to breast adversity till again welcomed to their smiling presence. Their thousand associations repress the unhallowed aspirations of ambition and vice; and when the last sun of decrepid age is sinking to its rest, these venerable monitors solace the expiring soul with the assurance, that a returning spring shall renew its existence beyond the winter of the tomb.

Trees ought not to stand too near the buildings, but occupy such a position as to give beauty and finish to the landscape. In addition to danger from lightning, blowing down, or the breaking off of heavy branches, there is an excessive dampness from their proximity, which produces rapid decay in such as are of wood, and which frequently affects the health of the inmates. Low shrubbery, that does not cluster too thickly and immediately around the house, is not objectionable. Trees are ornamental to the streets and highways, but should be at such a distance from the fences as will prevent injury to the crops and afford a grateful shade to the wayfarer. In certain sections of the Middle and Southern States, where the soil is parched from the long, sultry summers, it has been found that shade trees rather increased than diminished the forage of the pastures, but through most of the Middle and Northern States, they are decidedly disadvantageous, as the feed is found to be sweeter and more abundant beyond their reach. For this reason, such trees as are preserved exclu-

sively for timber should be kept together in the wood lots, and even many that are designed for necessary shade or ornament, may be grouped in tasteful copses, with greater economy of ground and manifest improvement to the landscape.

In the selection of trees, regard should be had not only to the beauty of the tree and its fitness for shade, but to its ultimate value as timber and fuel. The *elm*, in the Northern and Middle States, when standing isolated, is one of our most graceful and imposing trees. It grows to an immense size, with graceful projecting limbs and long pendent branches. It is liable to few diseases, and the fuel and timber are good for most purposes. Every one who has seen the patriarchal elms which grace the beautiful villages of the Connecticut valley, and other old towns of New England, must wish to see them universally disseminated. The *rock* or *sugar maple* is a beautiful tree, having a straight trunk and regular upward branching limbs, forming a top of great symmetry and elegance. Beside the ornament and thick shade it affords, it gives an annual return in its sap, which is used for making into sugar and syrup; the fuel is equal to any of our native trees; the timber is valuable, yielding the beautiful glossy *bird's-eye maple* so much esteemed for furniture. The *black walnut* is a stately, graceful tree, of great value for wood and durable timber, and besides its extensive use for plain, substantial furniture, the knots and crotches make the rich dark veneering, which rivals the mahogany or rosewood in brilliancy and lasting beauty. In fertile soil it likewise bears a highly flavored nut. The *butternut* is also a fine tree for shade, as well as for its rich flavored fruit. So, too, with the *shell* or *shagbark hickory*. The *white ash* has a more slender and stiffer top than either of the preceding, yet is light and graceful. The fuel is good, and the timber unequalled in value for the carriage maker. The *weeping willow*, in the Middle States, south of latitude 42°, is a tree of variegated foliage, and long, flexile twigs, sometimes trailing the ground for yards in length. Its soft silvery leaves are among the earliest of spring, and the last to maintain their verdure in the

autumn. Its timber is worthless and the wood of little value. The *black* and *white oaks*, on soil adapted to them, are trees of commanding beauty and stalwart growth. The foliage appears late, but is unsurpassed for depth and richness of color and highly polished surface, and retains its summer green long after the early frosts have mottled the ash and streaked the maple with their rainbow hues. When grown on dry and open land, both fue. and timber are valuable. The *locust* is a beautiful tree, of rapid growth, flowering profusely, and with layers or massive flakes of innumerable leaflets of the deepest verdure. The wood is unrivalled for durability as ship timber, except by the *live oak;* and for posts or exposure to the weather, it is only excelled by the savin, or red cedar. It has of late years been subject to severe attack and great injury from the borer, a worm against whose ravages hitherto there has been no successful remedy. Its chief drawback is its propensity to throw up suckers. The *button wood*, *sycamore*, or *plane tree*, by all of which names it is known in different parts of this country, is of gigantic dimensions, when occupying a rich and moist alluvial soil. One found on the banks of the Ohio measured forty-seven feet in circumference, at a height of four feet from the ground. Its lofty mottled trunk, its huge irregular limbs, and its numerous pendent balls, in which are compressed myriads of seeds, with their plumy tufts that are wafted to immense distances for propagation, have rendered it occasionally a favorite. They are often seen on the banks of our rivers, where the branches inter lock, and sometimes they completely span streams of considerable size. The wood is cross-grained and intractable for working, and the timber is of little use. This is a tree, however, in its native grandeur, of history more than of the present. For the last forty years, it has been afflicted with a disease which has dwarfed it growth and spoiled its shade. The great variety of American shade trees, both deciduous and evergreen, far surpasses that within the same area on any portion of the eastern continent,

but it would be transcending our limits farther to particularize them.

WOOD LANDS.

There are few farms in the United States where it is not convenient and profitable to have a wood lot attached. They supply the owner with his fuel, when coal is not accessible, which he can prepare at leisure times; they furnish him with timber for buildings, rails, posts, and for the occasional demands for implements; they also require little attention. The trees should be kept in a vigorous, growing condition, as the profits are as much enhanced from this cause as any of the cultivated crops. Few of our American fields require planting with forest trees. The soil is everywhere adapted to their growth, and being full of seeds and roots, when but recently deceased, they will everywhere spring up spontaneously. Even the oak openings of the West, with here and there a scattered tree, and such of the prairies as border upon wood lands, when rescued from the destructive effects of the annual fires, will rapidly shoot up into vigorous forests.

We have repeatedly seen instances of the re-covering of oak barrens and prairies with young forests, which was undoubtedly their condition before the Indians subjected them to conflagration; and they have, indeed, always maintained their foothold against these desolating fires, wherever there was moisture enough in the soil to arrest their progress. In almost every instance, if the germs of forest vegetation have not been extinguished in the soil, the wood lot may be safely left to self propagation, as it will be certain to produce those trees which are best suited to the present state of the soil. Slightly thinning the young wood may in some cases be desirable, and especially by the removal of such worthless shrubbery as never attains a size or character to render it of any value. Such are the alders, the blue beach, swamp willow, etc., and where there is a redundance of the better varieties of equal vigor, those may be removed that will be worth the least when matured. In most of our woodlands, however, nature is left to assert her own unaided preferences, growing what and how

she pleases, and, it must be confessed, she is seldom at variance with the owner's interest. Serious and permanent injury has often followed close thinning. In cutting over woodlands, it is generally best to remove all the large trees on the premises at the same time. This admits a fresh growth on equal footing, and allows that variety to get the ascendency to which the soil is best suited.

In the older settled States, where land and its productions are comparatively high, many adopt the plan of clearing off every thing; even burning the old logs and brush, and then sow one or more crops of wheat or rye, for which the land is in admirable condition, from the long accumulation of vegetable matter, and the heavy dressing of ashes thus received. They then allow the forest to resume its original claims, which it is not slow to do, from the abundance of seeds and roots in the ground. But unless the crop be valuable the utility of this practice is doubtful, as, by the destruction of all the young stuff which may be left, there is a certain delay of some years in the after growth of the wood; and the gradual decay of the old trunks and brush may minister fully as much to its growth as the ash which their combustion leaves; and the fertility of the soil is diminished just in proportion to the amount of vegetable matter which may have been abstracted by the grain crops taken off. The proper time for cutting over the wood must depend on its character, the soil, and the uses to which it is to be applied. For saw logs or frame timber, it should have a thrifty growth of forty or fifty years; but in the meantime much scattering fuel may be taken from it, and occasionally such mature timber trees as can be removed without injury to the remainder. For fuel alone, a much earlier cutting has been found most profitable.

The Salisbury Iron Company, in Connecticut, has several thousand acres of land, which were purchased and have been reserved exclusively for supplying their own charcoal. The intelligent manager informed us, when recently there, that from an experience of eighty years, they had ascertained the most

profitable period for cutting was once in about sixteen years, when everything was removed of an available size, and the wood was left entirely to itself, for another growth. It has been found that this yielded an annual interest on $16 to $20 an acre, which for a rough and rather indifferent soil, remote from a wood or timber market, will pay fully as much as the net profits on cultivated land in the neighborhood.

There are numerous hill and mountain ranges of land in many of our States, once cleared and cultivated to some extent, (particularly in the New England States,) which are now abandoned to the growth of wood, and wisely so, as more profitable than the lean returns of either cropping in grain, or grazing. They renew a good growth of wood in twenty to thirty years, at farthest, which may be worth, according to its locality, fifty to one hundred dollars per acre, when an acre of such land, cleared and in grass, would scarcely yield summer pasture for a single sheep. We have seen thousands of acres, once in farms, (on which, too, great men were born and grew to manhood,) now grown into wood. In old times, when all farm labor was done by hand, such land paid to live on as things then went; but, with the application of improved implements, by which hand labor has largely been superseded, and cannot be used in such rough lands, the ordinary crops cannot be profitably grown. Hence, they become, as farm lands, comparatively worthless. The warm, sheltered, sunny nooks are only reserved, which, by better cultivation, have become more profitable than the whole farm put together, under the old method of ranging over the broader surface, with the same amount of labor.

When young, the wood should be kept entirely free from sheep and cattle, as they feed upon the fresh shoots with nearly the same avidity as they do upon grass or clover, and when it is desirable to thicken the standing trees by an additional growth, cattle should be kept from the range till such time as the new sprouts or seedling may have attained a height beyond their reach. Where it is desirable to bring into woodland such fields

as have not forest roots or seeds already deposited in a condition for germination, the fields should be sown or planted with all the various nuts or seeds adapted to the soil, and which it is desirable to cultivate. Transplanting trees for a forest in this country, cannot at present be made to pay, from its large expense, and if the trees will not grow naturally or by sowing, the land should be continued in pastures or cultivation. There are some lands so unfitted for tillage by their roughness or texture, as to be much more profitable as woodland. It is better to retain such in forest, and make from them whatever they are capable of yielding, than by clearing and bringing them into use, to add them to what are perhaps already superfluous tillage fields, and become a drain on labor and manures which they illy repay.

In clearing lands, when it is desirable to reserve sufficient trees for a park or shade, a selection should be made of such as are young and healthy, which have grown in the most open places, with a short stem and thick top. It will tend to insure their continued and vigorous growth, if the top and leading branches be shortened. A large tree will seldom thrive when subjected to the new condition in which it is placed, after the removal of the shade and moisture by which it has been surrounded. They will generally remain stationary or soon decay; and the slight foothold they have upon the earth by their roots, which was sufficient for their protected situation while surrounded by other trees, exposes them to destruction from violent gales; and they seldom have that beauty of top and symmetry of appearance which should entitle them to be retained singly. If partialities are to be indulged for any, they should be surrounded by a copse of younger trees by which they will be in a measure protected. Young stocks should be left in numbers greater than are required, as many of them will die, and from the remainder selections can be made of such as will best answer the purpose designed. In the many hundreds of acres of original forest which we have had the supervision of clearing up, where we left occasional copses of large growth, they almost all died out in a few years.

We have of late seen many ingeniously written articles against the impolicy of clearing lands of their timber, as opening them to prolonged droughts, and, of course, destroying much of their value for agricultural purposes, and drying up the springs and streams. The *theory* for retaining the timber on the land, is—for we believe the proposition is theoretical only,—that the woods, or forests keep the land shaded, and so prevent evaporation of the water from the soil, thus letting the rains in to supply the springs, and promote their *perpetual* flow, while the low and swampy places, by retaining the collections of water within them to a continuous supply or inlet of the streams into which they run, keep them at a more equable volume; also, that the trees draw the rain from the passing clouds, break their misty volume, and arrest their progress into rain, when if the land were clear of trees the clouds and rain would pass into more favored quarters. Another branch of the theory is that in clearing up the land, the water courses are opened for immediately discharging the falling water from them, thus passing it rapidly into the larger streams and rivers, swelling them inordinately, and causing greater freshets than when the country was new, and thus causing droughts.

The answer to these propositions as it appears to us, is short and altogether probable and practical.

1st. Woods and forests take up quite as much moisture from the soil, in the support of their trunks, branches and leaves, thus evaporating it into the atmosphere from the soil, as growing crops do. If they retain the surplus water in swamps, it is of no *use* either to the trees themselves, or the streams into which they flow only for *mill power*, a matter of little consequence where farm lands are of much value.

2d. While we have millions of acres of prairie lands in many of our Western States, where for miles scarcely a tree is seen, and rains appear to be as abundant there as elsewhere, who can suppose that a wide forest of trees, not over a hundred feet high, while the clouds pass over at the height of several hundred, or several thousand feet above them can exercise any but the feeblest

influence in arresting their course, or break them into a discharge of their waters?

3d. Supposing the falling waters on cleared and cultivated lands do discharge themselves rapidly into the water courses, as they should do? If the parched ground needs the rain, it will absorb it to its full capacity for doing so. The surplus *ought* to run away, as it only damages the crops by lying on them. If the springs are really good for anything—that is, lie deep enough to give water in a dry time when they are really needed—their fountains lie too deep to be affected by summer rains. As for the freshets of recent years being so much greater than in olden times, we have little faith that they are so. Men's memories are short, and not always accurate.

THE PROPER TIME FOR CUTTING TIMBER.

Nine-tenths of the community think winter the time for this purpose, but the reason assigned, "that the sap is then in the roots," shows its futility, as it is evident to the most superficial observer that there is nearly the same quantity of sap in the tree at all seasons. It is less active in winter, and like all other moisture, is congealed during the coldest weather, yet when not absolutely frozen, circulation is never entirely stopped in the living tree. Reason or philosophy would seem to indicate that the period of the maturity of the leaf, or from the last of June to the first of November, is the season for cutting timber in its perfection. Certain it is, that we have numerous examples of timber cut at this period, which has exhibited a durability twice or three times as great as that cut in winter, when placed under precisely the same circumstances. After it is felled, it should at once be peeled, drawn from the woods and elevated from the ground to facilitate drying, and if it is intended to be used under cover, the sooner it is put there the better. Wood designed for fuel, will spend much better when cut as above mentioned and immediately housed, but as this is generally inconvenient, from the labor of the farm being then required for the harvesting of

the crops, it may be more economical to cut it whenever there is most leisure.

Preservation of Timber.—Various preparations, of late years, have been tried for the more effectual preservation of timber, which have proved quite successful, but the expense precludes their adoption for general purposes. Chemistry, in its later developments, has aided much in the knowledge of the best compositions for preserving timber, when exposed to the weather, from the destructive action of the elements; and from the continuous experiments still made, it is hoped that different, cheap, and effective preparations, with their modes of application, will ere long be found for common use. Under water, without special preparation, almost any kind of timber will endure sound for centuries. Gas-tar, salts, crude petroleum, and alkalies of a cheap kind and easily procured, are now his chief material, and answer a tolerable purpose. But something still more enduring than these have proved, awaits the farmer's demands, and should be afforded within the limits of his means. The cost of obtaining the present known *chemical* compounds, usually termed kyanizing, is too great with the large majority. Although the expense of these preparations may prevent their use for large, cheap structures, yet for all the lighter instruments, such as farmer's tools, plows, etc., where the cost of wood is inconsiderable, in comparison with that of making, it would be economy to use such timber only, as will give the longest duration, though its first price may be ten-fold that of the more perishable material.

FARMING TOOLS.

These should form an important item of the farmer's attention, as upon their proper construction depends much of the economy and success with which he can perform his operations. There have been great and important improvements within the past few years, in most of the implements, which have diminished the expense while they have greatly improved the mechanical operations of agriculture. We have studiously avoided a reference to

any of these, as there are many competitors for similar and nearly equal improvement, and in this career of sharp and commendable rivalry, what is the best to-day, may be supplanted by something better to-morrow. These implements may now be found at the agricultural warehouses, of almost every desirable variety. Of these, the best only should be procured; such as are the most perfect in their principles and of the most durable materials. The wood work should be well guarded with paint, if to be exposed to the weather, and the iron or steel with paint, or a coating of hot tar, unless kept brightened by use. When required for cutting, they should always be sharp, even to the hoe, the spade, and the share and coulter of the plow. When not in use, they ought to be in a dry place. Plows, harrows, carts and sleds, should all be thus protected, and by their longer durability they will amply repay the expense of shed room. They ought also to be kept in the best repair, which may be done at leisure times so as to be ready for use. (Some additional remarks on this subject will be found under the head of "plows.")

THE AGRICULTURAL EDUCATION OF THE FARMER.

Though last mentioned, this is of the first importance to the farmer's success. It should commence with the thorough groundwork attainments, everywhere to be acquired in our primary schools, and should embrace the elementary knowledge of mechanics, botany, chemistry and geology; nor can it be complete without some acquaintance with anatomy and physiology. The learner ought then to have a complete, practical understanding of the manual operations of the farm, the best manner of planting, cultivating and securing crops; he should be familiar with the proper management, feeding and breeding of animals; the treatment of soils, the application of manures, and all the various matters connected with agriculture.

This will be but the commencement of his education, and it should be steadily pursued through the remainder of his life. He must learn from his own experience, which is the most certain and

complete knowledge he can obtain, as he thus ascertains all the circumstances which have led to certain results; and he should also learn from the experience of his neighbors, and from his personal observation on every subject that comes within his notice. He will be particularly assisted by the cheap agricultural journals of the present day, which embrace the latest experience of some of our best farmers, throughout remote sections of country, on almost every subject pertaining to his occupation. To these should be added the selection of standard, reliable works, on the various topics of farming, and of the latest authority, which can be procured for direction and reference.

It is hoped that the *agricultural schools and colleges*, now being so generally established in our different States, in aid of the farming interests of the country, where experienced and gifted minds should be placed, surrounded by the means for conveying instruction in the fullest, yet most simple and effective manner, and with every requisite for practical illustration, may prove of signal benefit. We cannot permit ourselves to doubt that this neglected field will soon be efficiently occupied, and thus supply the only link remaining in the thorough education of the farmer.

CHAPTER XIII.

FARM BUILDINGS.

This is a subject so various and extensive in its discussion, that we can, here, barely touch upon it. Only general hints and suggestions can here be made, the subject itself requiring a full treatise by an author competent to its mastery.

Great neglect still prevails in this country, in the erection of suitable farm buildings. The deficiency extends not only to their number, which is often inadequate to the wants of the farm, but more frequently to their location, arrangement and manner of construction. The annual losses which occur in consequence of this neglect, would, in a few years, furnish every farm in the Union with barns and outhouses entirely sufficient for the necessities of each. We will give briefly, in detail, the leading considerations which should govern the farmer in their construction.

THE FARM HOUSE.

If this is required for the occupation of the owner, it may be of any form and size his means and taste dictate. If for a tenant, and to be employed solely with a reference to its value to the farm, it should be neat, comfortable, and of convenient size. It should especially contain a cool, airy and spacious dairy room, unless the owner should prefer one independent of the house, over a clear spring or cool rivulet, where, partially protected from the sun by a sheltering bank, half buried in the earth, and made, as it should be, if possible, of stone, the cool atmosphere within will afford the best safeguard against flies and other insects, and preserve the butter and cheese in the finest condition. Stone

or brick are the best materials for dwellings, as they are cooler in summer and warmer in winter, and if comfort be the object of the farmer's toil, there is certainly no place where it should be sooner consulted than in his own domicile. A naked, scorching exposure, equally with a bleak and dreary one, is to be avoided. The design of a house is protection to its inmates, and if there be no adequate shelter from the elements, it fails in its purpose. It should be tastefully built, as this need not materially increase the expense, while it adds a pleasant feature to the farm. It ought to occupy a position easily accessible to the other buildings and the fields, and yet be within convenient distance of the highway. It is desirable to have it so far removed as to admit of a light screen of trees, and nature will thus add an ornament and protection, in the surrounding foliage, which no skill of the architect can equal.

The Cellar.—This is an essential appendage to a house, particularly where roots are to be stored. Many appropriate a part of it to the dairy, and if thus employed it should be high, clean and well ventilated. The proper preservation of what is contained in it, and the health of the inmates, demand a suitable dryness and free circulation of air. The cellar is frequently placed on the side of a hill, which renders it more accessible from without. This is in no respect objectionable, if the walls are made sufficiently tight to exclude the frosts. When on level ground, they should be sunk only three or four feet below the natural surface, and the walls raised enough above to give all the room wanted; and the excavated earth can be banked around the house, thus rendering it more elevated and pleasant. It also provides for the admission of light and air through small windows, which are placed above the ground. A wire gauze, to exclude flies, ought to occupy the place of the glass in warm weather, and, if liable to frosts, there should be double sashes in winter. Ventilation is important in all seasons, and it may be secured by as large an aperture as possible connected with the chimney, and the windows may be thrown open in pleasant weather during the

warmer part of the day. The cellar should be connected with the kitchen or sheds above, by safe, well lighted stairs. And, lastly, the entire building should be rat-proof. This is more easily accomplished than is generally imagined. When erecting a building, a carpenter, or mason, for less than the additional expense of a year's support for a troop of rats, can forever exclude them from it, by the exercise of a little ingenuity. A brick floor in a cellar is easily broken up by these insidious and ever-busy vermin, and a plank or wooden floor is objectionable, from its speedy decay. The most effective and permanent barrier to their inroads is afforded by a stone pavement, laid with large pieces, in cement, closely fitted to each other and to the side walls. This is also secured by placing a bed of small stones and pebbles on the ground, and *grouting*, or pouring over it a mortar made of lime and sand, so thin as to run freely between the stones. When dry, a thin coating of water-lime cement is added, which is smoothed over with the trowel. This can be so laid as to admit of ready and perfect drainage, by a depression in the center or sides, which answers for gutters.

THE BARN

Is a very important appendage of the farm, and its size and form must depend on the particular wants of the owner. It is sometimes essential to have more than one on the premises, but in either case they should be within convenient distance of the house. They should be large enough to hold all the fodder and animals on the farm. Not a hoof about the premises should be required to brave our Northern winters, unsheltered by a tight roof and a dry bed. They will thrive so much faster, and consume so much less food when thus protected, that the owner will be ten-fold remunerated. Disease is thus often prevented, and if it occurs, is more easily removed. The saving in fodder, by placing it at once under cover when cured, is another great item of consideration. Besides the expense of stacking and fencing, the waste of the tops and outside fodder in small stacks, is fre-

quently one-fourth of the whole, and if carelessly done, it will be much greater. There is a further expense of again moving it to the barn, or foddering it in the field, which greatly increases the waste.

It is a convenient mode to place a barn on a side hill, inclining to the south-east, whenever the position of the ground admits of it. There are several advantages connected with this plan. Room is obtained by excavating and underpinning, more cheaply than in building above. An extensive range of stabling may be made below, which will be warmer than what is afforded by a wooden building, and the mangers are easily supplied with the fodder which is stored above. Extensive cellar room can be had next to the bank, in which all the roots required for the cattle can be safely stored yet near to their mangers, and where they are easily deposited from carts through windows arranged on the upper side, or scuttles in the barn floor above. More room is afforded for hay in consequence of placing some of the stables below, and in this way, a large part of the labor of pitching it on to elevated scaffolds is avoided. The barn and shed ought to be well raised on good underpinnings, to prevent the rotting of sills, and to allow the free escape of moisture, as low, damp premises are injurious to the health of animals.

Every consideration ought to be given to the saving of manure. The stables should have drains that will carry off the liquid evacuations to a muck heap or reservoir, and whatever manure is thrown out, should be carefully protected. Sheds for composting muck, sods, etc., may well be used, in which pits are sunk and moisture applied, as may be needed. A low roof, projecting several feet over the manure which is thrown from the stables, will do much to prevent waste from sun and rains. The mangers ought to be so constructed as to economize the fodder. Box feeding for the cattle we prefer, as in addition to hay, roots and meal may be fed in them without loss; and with over-ripe hay, a great deal of seed may in this way be saved, which will diminish the quantity necessary to be purchased

for sowing. The fine leaves and small fragments of hay are also kept from waste, which in racks are generally lost by falling on the floor. We object to racks, unless provided with a shallow box underneath, and to foddering in the open yards. There is a loss in dragging the forage to them, and too often this is done near a herd of hungry cattle, which gore each other, and are scarcely to be kept at bay by the use of the stoutest goad. There is also a waste of the hay which falls while the cattle are feeding, and which is largely increased in muddy yards; added to which, the animals are exposed to whatever bad weather there may be while eating, which is at all times to be deprecated.

SHEDS.—Feeding in sheds is convenient, and in many instances may take the place of the stall or stable. They are frequently and very properly arranged on two sides of the cattle yard, the barn forming one end, and the other opening to the south, unless this is exposed to the prevailing winds. This arrangement forms a good protection for the cattle; and the sheds being connected with the barn, is of importance in economizing the labor in foddering. The racks or boxes are placed on the boarded side of the shed, which forms the outer side of the yard, and they are filled from the floor overhead. If the space above is not sufficient to contain the necessary quantity of fodder, it should be taken from the mows or scaffolds of the barn, and carried or dragged over the floor to the place wanted. The floors ought to be perfectly tight to avoid waste, and the sifting of the particles of hay or seed on the cattle or sheep. Unless the ground under the shed be quite dry, it is better to plank it, and it will then admit of cleaning with the same facility as the stables. A portion of the shed may be partitioned off for close or open stalls, for colts, calves or infirm cattle, and cows or ewes that are heavy with young. A little attention of this kind will frequently save the life of an animal, or add much to their comfort and the general economy of farm management. The surplus straw, cornstalks and the like, can be used for bedding, though it is generally preferable to have them cut and fed to the cattle.

WATER FOR THE CATTLE YARD,

Is an important item, and if the expense of driving the animals to a remote watering place, the waste of manure thereby occasioned, the straying of cattle, and sometimes loss of limbs or other injury, resulting from their being forced to go down icy slopes, or through excessive mud, to slake their thirst—if all these considerations are taken into account, they will be found annually to go far towards the expense of supplying water in the yard, where it would at all times be accessible. All animals require water in winter, except such as have a full supply of roots; and though they sometimes omit going to distant and inconvenient places where it is to be had, they may, nevertheless, suffer materially for the want of it. When it is not possible to bring a stream of running water into the yard, or good water is not easily reached by digging, an effectual way of procuring a supply through most of the year, is by the construction of

CISTERNS.—Where there is a compact clay, no further preparation is necessary for stock purposes, than to excavate to a sufficient size, in a dishing shape at bottom, and lay a thick coat of water-lime cement all over the inner surface, and cover with a stout frame top, heavily planked over the surface. Through this top a pump can be permanently placed. This should be made near the buildings, and the rains carefully conducted by the eaves-troughs and pipes, from an extensive range, will afford an ample supply.

For household purposes, one should be made with more care and expense, and so constructed as to afford pure filtered water at all times. These may be formed in various ways, and of different materials, stone, brick, or even wood; though the two former are preferable. They should be permanently divided into two apartments, one to receive the water, and another for a reservoir to contain such as is ready for use. Alternate layers of gravel, sand, and charcoal at the bottom of the first, and sand and gravel in the last, are sufficient; the water being allowed to

pass through the several layers mentioned, will be rendered perfectly free from all impurities. Some who are particularly choice in preparing water, make use of filtering stones, but this is not essential. Occasional cleaning may be necessary, and the substitution of new filtering materials will at all times keep them sweet.

For stock uses, pumping the water into troughs from the cisterns, is the most ready way to draw it, and this may be done, according to the quantity of stock kept, by either hand, horse, or wind power—the last of which, with a good mill, is the cheapest.

THE CARRIAGE HOUSE, STABLE, GRANARY, BINS, ETC.

The carriage house and horse stable sometimes occupy a distinct building, which is a good precaution against fire, and where this is the case, it is frequently convenient to have the upper loft for a granary. The propriety of having this proof against rats is obvious. Yet it should be capable of thorough ventilation when the grain is damp, or exposed to injury from want of air. Entire cleanliness of the premises, is the best remedy against weevil and other noxious insects.

THE CORN CRIB.—If there be more Indian corn on the premises than can be thinly spread over an elevated, dry floor, the corn crib for storing it should occupy an isolated position. This should be made of upright lattice work, with a far projecting roof, and sides inclining downwards to each other, so as to avoid the admission of rain. The corn in the cob is stored in open bins on either side, leaving ample room in the center for threshing, or the use of the corn sheller. Close bins may occupy the ends for the reception of the shelled grain. All approach from rats and other vermin, may be avoided by placing the building on posts, with projecting stones or sheet iron on the top, and so high that they cannot reach it by jumping.

A TOOL HOUSE AND WORK SHOP ought always to have a place about the premises. In this building, all the minor tools may be arranged on shelves, or in appropriate niches, where they can at

once be found, and will not be exposed to theft. Here, too, the various farming tools may be repaired, which can be anticipated and done in those leisure intervals which often occur. *Ample shed room for every vehicle and implement about the farm*, should not be wanting. Their preservation will amply repay the cost of such slight structures as may be required to house them. A wagon, plow, or any wooden implement, will wear out sooner by exposure to all weathers without use, than by careful usage with proper protection.

A HORSE POWER, either stationary or movable, can be made to contribute greatly to the economy of farming operations, where there is much grain to thresh, or straw, hay, or cornstalks to cut. With the aid of this, some of the portable mills may crush and grind much of the grain required for feeding. Even the water may be pumped by it into large troughs for the use of cattle, and all the fuel sawed, thereby saving more expensive labor.

A STEAMING APPARATUS.

Where there are many swine to fatten, or grain is to be fed, this is at all times an economical appendage to the farm. It has been shown, from several experiments, that, except in roots, for all animals, excepting store sheep, and, perhaps, even they may be excepted, grain or meal is better for feeding when cooked. Food must be broken up before the various animal organs can appropriate it to nutrition; and whatever is done towards effecting this object, before it enters the stomach, diminishes the necessity for the expenditure of vital force in accomplishing it, and thereby enables the animal to thrive more rapidly, and do more labor, on a given amount. For this reason, we apprehend, there may have been some errors undetected in the experiments in feeding sheep and cattle with raw and cooked roots, which results in placing them apparently on a par as to their value for this purpose. The crushing or grinding of the grain insures more perfect mastication, and is performed by machinery at much less expense, than by the animals consuming it. The steaming or

boiling is the final step towards its easy and profitable assimilation in the animal economy. With a capacious steaming-box for the reception of the food, the roots and meal, and even cut hay, straw and stalks, may be thrown in together, and all will thus be most effectually prepared for nourishment. There is another advantage derivable from this practice. The food might at all times be given at the temperature of the animal system, about 98° Fahrenheit, and the animal heat expended in warming the cold and sometimes frozen food, would be avoided.

The steaming apparatus is variously constructed. We have used one consisting of a circular boiler five and a half feet long by twenty inches diameter, made of boiler iron, and laid lengthwise on a brick arch. The fire is placed underneath, and passes through the whole length and over one end, then returns in contact with the boiler through side flues, or pockets, where it entered the chimney. This gives an exposure to the flame and heated air of about ten feet. The upper part is coated with brick and mortar, to retain the heat, and three small test cocks are applied at the bottom, middle and upper edge of the exposed end, to show the quantity of water in it; and two large stop cocks on the upper side, for receiving the water and delivering the steam, completes the boiler. The steaming box is oblong, seven or eight feet in length, by four feet in depth and width, capable of holding sixty or seventy bushels, made of plank grooved together, and clamped and keyed with four sets of oak joist. We also used a large circular tub, strongly bound by wagon tire, and keyed, and holding about twenty-five bushels. The covering of both must be fastened securely, but a safety valve is allowed for the escape of steam, which is simply a one and a half inch auger hole. Into these the steam is conveyed from the boiler by a copper tube, attached to the steam delivery cock, for a short distance, when it is continued into the bottom of the box and tub by a lead pipe, on account of its flexibility, and to avoid injury to the food from the corrosion of the copper. It is necessary to have the end of the pipe in the steaming box

properly guarded by a metal strainer, to prevent its clogging from the contents of the box. We find no difficulty in cooking fifteen bushels of unground Indian corn, in the tub, in the course of three or four hours, and with small expense of fuel. Fifty bushels of roots could be perfectly cooked in the box, in the same time. For swine, fattening cattle and sheep, milk cows and working horses, and perhaps oxen, we do not doubt a large amount of food may be saved by the use of such or a similar cooking apparatus. The box may be enlarged to treble the capacity of the foregoing, without prejudicing the operation, and even with a boiler of the same dimensions, but it would take a longer time to effect the object. If the boiler were increased in proportion to the box, the cooking process would, of course, be accomplished in the same time.

The materials for farm buildings we have assumed to be of wood, from the abundance and cheapness of this material, generally, in the United States. Yet we always prefer, when not too expensive, or where the capital could be spared, that brick or stone should take their place. They are more durable, are less exposed to fire, and they sustain a more equable temperature in the extremes of the seasons. Barns and sheds cannot, like houses, be conveniently made rat-proof, but they may be so constructed as to afford them few hiding places, where they will be out of the reach of cats and terrier dogs, which are always indispensable around infested premises. These and an occasional dose of arsenic, carefully and variously disguised, will keep their numbers within reasonable bounds. If poison be given, it would be well to shut up the cats and terriers for three or four days, until the object is effected, or they, too, might partake of it.

LIGHTNING RODS.

In the hot, dry weather of our American summers, thunder showers are frequent, and often destructive to buildings. This danger is much increased for such barns as have just received their annual stores of newly cut hay and grain. The humid

gases driven off by the heating and sweating process, which immediately follows their accumulation in closely packed masses, offers a strong attraction to electricity, just at the time when it is most abundant. It is then an object of peculiar importance to the farmer to guard his buildings with properly constructed lightning rods, and they are a cheap mode of insurance against fire from this cause, as the expense is trifling and the security great.

It is a principle of general application, that a rod will protect an object at twice the distance of its height, above any given point, in a line perpendicular to its upper termination. Thus, a rod attached to one side of a chimney four feet diameter, must have its upper point two feet above the chimney to protect it. The height above the ridge must be at least one-half the greatest horizontal distance of the ridge from the perpendicular rod.

Materials and Manner of Construction.—The rod may be constructed of soft, round or square iron, the latter being preferable, in pieces of convenient length, and of not less than three-fourths of an inch in diameter. They should not be hooked into each other, but attached either by screwing the ends together, or forming a point and socket to be fastened by a rivet, so that the rod, when complete, will appear as one continuous surface of equal size throughout. If a square rod be used, it will attract the electricity through its entire length, if the corners be notched with a single, downward stroke of a sharp *cold chisel*, at intervals of two or three inches. Each of these will thus become a point to attract and conduct the electricity to the earth. A bundle of wires, thick ribbons, or tubes of metal, would be much better conductors than an equal quantity of matter in the solid, round, or square rods, as the conducting power of bodies is in the ratio of their surface. No part of the rod should be painted, as its efficiency thereby is greatly impaired. The upper extremity may consist of one, two, or more finely drawn points, which should be of copper, silver, or iron, well gilded, to prevent rusting. The lower part of the rod, at the surface of the ground, should terminate in two or three flattened, diverging branches, leading several

feet outwardly from the building, and buried to the depth of perpetual moisture, in a bed of charcoal. Both the charcoal and moisture are good conductors, and will insure the passage of the electricity into the ground, and away from the premises. The rod may be fastened to the building by glass or well seasoned wood, boiled in linseed oil, then well baked and covered with several coats of copal varnish.

After all, there are different opinions about the value of lightning rods. Some consider them of no account whatever. Very much of their utility depends on the size and the manner in which they are constructed. The little, light things that are commonly peddled over the country are not worth the trouble of putting them up.

ICE-HOUSES, HEN-HOUSES, PIG-STYES, ETC.,

May be multiplied almost indefinitely as the wants and pleasure of the farmer may demand. They are, indeed, all necessary in a complete farm establishment, and their modes of construction so varied, or fanciful, that no written description will suit every one alike. Our agricultural periodicals, and various books written expressly on such subjects, give many different plans—some of them not so practical as others, we admit—but most of them convenient and useful. A complete farm establishment, in its buildings, usually makes a little village of itself. All the structures should be so placed as to be convenient of access to the main dwelling, and the laborers' cottages, whenever erected, handy to the every day work of the concern.

The question may be discussed whether the various accommodations for stock, feeding, etc., may not be better under one roof.

The proper arrangement of all these is a matter of study, and they should be deliberately planned and laid out, as without such precaution, much, even a life time, inconvenience and expense will be entailed on the occupants for want of a proper forethought in their structures and arrangements. The question of insurance against fire is to be considered.

CHAPTER XIV.

DOMESTIC ANIMALS.

The principal domestic animals reared for economical purposes in the United States are horned, or neat cattle, the horse, the mule, sheep and swine. A few asses are bred, but for no other object than to keep up the supply of jacks, for propagating mules. We have, also, goats, rabbits, and the house domestics, the dog and cat; the two former in large and growing numbers, but both the latter much beyond our legitimate wants. There have been, within late years, considerable numbers of the Cashmere and Angora goat imported, which, in their increase and dissemination, will test their value for increasing our agricultural resources. We shall confine ourselves to some general considerations connected with the first mentioned and most important of our domestic animals.*

The purpose for which animals are required, is first of consequence to be determined, before selecting such as may be necessary either for breeding or use. Throughout the North-eastern States, cows for the dairy, oxen for the yoke, and beef for the butcher, are wanted. In much of the West and South, beef alone is the principal object, while the products of the dairy, until recently, have been considered of less importance as commodity for distant markets, and the work of the ox is seldom relied on. except for occasional drudgery. Sheep may be wanted almost

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*** The subject of breeding and management of farm stock is of such importance, that, for more particular information than our limited space will permit, we must refer the reader to the several treatises extant, comprising their histories, modes of breeding, and general management. A full dissertation on farm stock would require several volumes.**

exclusively for the fleece, or for the fleece and heavy mutton, or, in the neighborhood of markets, for large, early lambs. The pastures and winter food, climate and other conditions, present additional circumstances, which should be well considered before determining on the particular breed, either of cattle or sheep, that will best promote the interest of the farmer. The kind of work for which the horse may be wanted, whether as a roadster, for the saddle, as a heavy team horse, or the horse of all work, must be first decided, before selecting the form or character of the animal. The range of pig excellence is more circumscribed, as it is only necessary to breed such as will yield the greatest amount of valuable carcass, within the shortest time, and with the least expense.

PRINCIPLES OF BREEDING.

All breeding is founded on the principle that *like begets like*. This is, however, liable to some exceptions, and is much more generally true when *breeding down* than when *breeding up*. If two animals which can never be exactly similar in all respects, are requisite to the perpetuation of the species, it necessarily results that the progeny must differ in a more or less degree from each parent. With wild animals and such of the domestic as are allowed to propagate without the interference of art, and whose habits, treatment and food are nearly similar to their natural condition, the change through successive generations is scarcely perceptible. It is only when we attempt to improve their good qualities, that it is essential carefully to determine, and rigidly to apply, what are adopted as the present scientific principles of breeding. We cannot believe that we have penetrated beyond the mere threshold of the art. Unless, then, we launch into experiments, which are necessarily attended with uncertainty, our duty will be to take for our guide the most successful practice of modern times, until further discoveries enable us to modify or add to such as are already known and adopted. We may lay down, then, as the present rules for this art,

1st. That the animals selected for breed should unite in themselves all the good qualities we wish to perpetuate in the offspring.

2d. These qualities, technically called *points*, should be in-bred in the animals as far as practicable, by a long line of descent from parents similarly constituted. The necessity for this rule is evident from the fact, that in mixing different species, and especially mongrels, with a long established breed, the latter will most strongly stamp the issue with its own peculiarities. This is forcibly illustrated in the case of the foreign cattle of ancient races, whose color, form and characteristics are strikingly perpetuated, sometimes to the sixth or even a later generation. So far is this principle carried by many experienced breeders, that they will use an animal of indifferent external appearance, but of approved descent, (*blood*,) in preference to a decidedly superior one, whose pedigree is imperfect.

3d. All the conditions of soil, situation, climate, treatment, and food, should be favorable to the object sought.

4th. Perfect health, and sound constitution in the breeding animals, and freedom from blemish, either inherent or chronic.

5th. As a general rule, the female should be relatively larger than the male. This gives ample room for the perfect development of the fœtus, easy parturition, and a large supply of milk for the offspring, at a period in its existence when food has a greater influence in perfecting character and form than at any subsequent time.

6th. Exceptions to this rule may be made, when greater size is required than can be obtained from the female, and especially when more vigor and hardiness of constitution are desirable. For this purpose, strong masculine development in the sire is proper, and, if otherwise unattainable, something of coarseness may be admitted, as this may be afterwards corrected; but nothing will atone for want of constitution and strength.

7th. Pairing should be with a strict reference to correcting the imperfections of one animal by a corresponding excellence in the other.

8th. *Breeding in-and-in*, or propagating from animals nearly allied, may be tolerated under certain circumstances. When the animal possesses much stamina and peculiar merit, which it is

desired to perpetuate in the breed, it may be done either in the ascending or descending line, as in breeding the son to the parent, or the parent to his own progeny. This has been practiced with decided advantage, and in some cases has even been continued successively as low as the sixth generation.

9th. Yet, with inexperienced breeders it is usually better to avoid close relationship, by the selection of equally meritorious stock-getters of the same breed, from other sources, unless the breeder be a perfect master of the art of close breeding. It requires the soundest judgment and long experience to long follow in-and-in breeding with entire success.

10th. Wholesome, nutritious food, at all times sufficient to keep the animals steadily advancing, should be provided, but they should never be allowed to get fat. Of the two evils, starving is preferable to surfeit. Careful treatment and the absence of disease must be always fully considered.

11th. Animals should never be allowed to breed either too early or too late in life. These periods cannot be arbitrarily laid down, but must depend on their time of maturity, the longevity of the breed, and the stamina of the individual.

12th. No violent cross or mixing of distinct breeds should ever be admitted for the purpose of perpetuation, as of cattle of diverse sizes; horses of unlike characters: the merino and long wools, or even the long or short and the middle wooled sheep. For carcass and constitution, the last named crosses are unexceptionable; and it is a practice common in this country, and well enough, where the whole produce is early destined for the shambles. But when the progeny are designed for breeders, the practice tends to a total uncertainty in fixed character, and quality.

GENERAL FORM AND CHARACTERISTICS OF DOMESTIC ANIMALS.

Within certain limits, these may be reduced to a common standard. All animals should have a good head, well set up; a clean, fine muzzle, and a bright, clear and full, yet perfectly placid eye. With the exception of the dog and cat, whose original nature is ferocity, and whose whole life, unless diverted from their

natural instincts, is plunder and prey; and the race horse, which is required to take the purse, at any hazard of life or limb to the groom; a mild, quiet eye is indispensable to the profitable use of the domestic brute. The neck should be well formed, not too long, tapering to its junction with the head, and gradually enlarging to a firm, well expanded attachment to the back, shoulders and breast. The back or chine should be short, straight and broad; the ribs springing out from the backbone nearly at right angles, giving a rounded appearance to the carcass, and reaching well behind to a close proximity to the hip; tail well set on, and full at its junction with the body, yet gradually tapering to fineness; thighs, fore-arms and crop well developed; projecting breast or brisket; the fore-legs straight, and hind ones properly bent, strong and full where attached to the carcass, but small and tapering below; good and sound joints; dense, strong bones, but not large; plenty of fine muscle in the right places; and hair or wool fine and soft. The chest in all animals should be full, for it will be invariably found that only such will do the most work, or fatten easiest on the least food.

The Lungs.—From the above principle, founded on long experience and observation, Cline inferred, and he has laid it down as an incontrovertible position, that the lungs should always be large; and Youatt expresses the same opinion. This is undoubtedly correct as to working beasts, the horse and the ox, which require full and free respiration, to enable them to sustain great muscular efforts. But later physiologists, Playfair and others, perhaps from closer and more accurate observation, have assumed that the fattening propensity is in the ratio of the smallness of the lungs. Earl Spencer has observed that this is fully shown in the pig, the sheep, the ox, and the horse, whose aptitude to fatten and smallness of lungs, are in the order enumerated. This position is further illustrated by the different breeds of the same classes of animals. The Leicester sheep have smaller lungs than the South Down; and it was found in an experiment made on Lord Ducie's example farm, that a number of the former, on a given quantity of food, and in the same time, reached twenty-

eight pounds a quarter, while the South Downs, with a greater consumption of food, attained, in the same period, only eighteen pounds. The Chinese pigs have much smaller lungs than the Irish, and the former will fatten to a given weight on a much less quantity of food than the latter. The principle would seem to be corroborated by the fact, that animals generally fatten faster in proportion to the quantity of food they consume, as they advance towards a certain stage of maturity; during all which time, the secretion of internal fat is gradually compressing the size, by reducing the room for the action of the lungs. Hence, the advantage of carrying the fattening beast to an advanced point, by which not only the quality of carcass is improved, but the quantity is relatively greater for the amount of food consumed. These two propositions appear to be at variance, and the exact truth may lie with neither. If the fuller development of the chest, which we esteem a point of great excellence in the animal, promote larger lungs, we decidedly incline to the latter. These views are intimately connected and fully correspond with the principles of

RESPIRATION IN ANIMALS.

From careful experiments, it has been found that all animals daily consume a much larger quantity of food than the aggregate of what may have been retained in the system, added to what has been expelled in the fœces and urine, and what has escaped by perspiration. Boussingault, who combines the characteristics of an ingenious chemist, a vigilant observer and practical agriculturist, made an experiment with a "milk cow and a full grown horse, which were placed in stalls so contrived that the droppings and the urine could be collected without loss. Before being made the subject of experiment, the animals were ballasted or fed for a month with the same ration that was furnished to them during the three days and three nights which they passed in the experimental stalls. During the month, the weight of the animals did not vary sensibly; a circumstance which happily enables us to assume that neither did the weight vary during the seventy-two hours when they were under especial observation.

"The cow was foddered with after-math, hay, and potatoes; the horse with the same hay, and oats. The quantities of forage were accurately weighed, and their precise degree of moistness and their composition were determined from average samples. The water drank was measured, its saline and earthy constituents having been previously ascertained. The excrementitious matters passed were of course collected with the greatest care; the excrements, the urine, and the milk were weighed, and the constitution of the whole estimated from elementary analysis of average specimens of each. The results of the two experiments are given in the following tables.

"The oxygen and hydrogen that are not accounted for in the sum of the products, have not disappeared in the precise proportions requisite to form water; the excess of hydrogen amounts to as many as from thirteen to fifteen penny-weights. It is probable that this hydrogen of the food became changed into water by combining, during respiration, with the oxygen of the air."

Food Consumed by the Horse in 24 hours.

Forage.	Weight in the wet state.	Weight in the dry state.	Elementary matter in the food. Carbon.	Hydrogen.	Oxygen.	Azote.	Salts and Earths.
	lbs.	lbs. oz.	lbs. oz.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.
Hay, ...	20	17 4	7 11	0 10 7	6 8 8	0 3 2	1 6 14
Oats, . . .	6	5 2	2 7	0 3 18	1 10 14	0 1 7	0 2 10
Water, . . .	43	..	..	..	..	..	0 0 8
Total, . .	69	22 6	10 6	1 2 5	8 7 2	0 4 9	1 9 12

Products Voided by the Horse in 24 hours.

Products.	Weight in the wet state.	Weight in the dry state.	Elementary matter in the products. Carbon.	Hydrogen.	Oxygen.	Azote.	Salts and Earths.
	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.
Urine, . . .	3 6 15	9 9 14	0 3 10	0 0 7	0 1 2	0 1 4	0 3 10
Excrements,	38 2 2	9 5 6	3 7 17	0 5 15	3 6 14	0 2 10	1 6 10
Total, . .	71 8 17	10 3 0	3 11 7	0 6 2	3 7 16	0 3 14	1 10 0
Total mat'r of food,	69 0 0	22 6 0	10 6 0	1 2 5	8 7 2	0 4 9	1 9 12
Difference, .	27 3 3	12 3 0	6 6 13	0 8 3	4 11 6	0 0 15	0 0 8

Water Consumed by the Horse in 24 hours.

	lbs. oz.
With the hay, ...	2 3
With the oats, ...	0 14
Taken as drink, ...	35 3
Total consumed, ...	38 4

Water Voided by the Horse in 24 hours.

	lbs. oz.
With the urine, ...	2 6
With the excrements, ...	23 8
Total voided, ...	25 14
Water consumed, ...	38 4

Water exhaled by pulmonary and cutaneous transpiration, ...	12 6

Food Consumed by the Cow in 24 hours.

Fodder.	Weight in the wet state.	Weight in the dry state.	Carbon.	Hydrogen.	Oxygen.	Azote.	Salts and Earths.
			Elementary matter of the food.				
	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb oz. dwt.
Potatoes, . .	40 2 5	11 2 1	4 11 2	0 7 15	4 10 17	0 1 12	0 6 13
After-math hay,	20 1 2	16 11 0	7 11 11	0 11 7	5 10 17	0 4 17	1 8 6
Water, . . .	160 0 0	..	..	..	..	..	0 1 12
Total, . .	220 3 7	28 1 1	12 10 13	1 7 2	10 9 14	0 6 9	2 4 11

Products Voided by the Cow in 24 hours.

Products.	Weight in the wet state.	Weight in the dry state.	Carbon.	Hydrogen.	Oxygen.	Azote.	Salts and Earths.
			Elementary matter in the products.				
	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.	lb. oz. dwt.
Excrements,	76 1 9	10 8 12	4 7 0	0 6 13	4 0 9	0 2 19	1 3 8
Urine, . .	21 11 12	2 6 17	0 8 7	0 0 16	0 8 3	0 1 3	1 0 6
Milk, . . .	22 10 10	3 1 0	1 8 3	0 3 3	0 10 6	0 1 9	0 1 16
Total, . .	120 11 11	16 4 9	6 11 10	0 10 12	5 6 18	9 5 11	2 5 10
" mat. food,	220 3 7	28 1 1	12 10 13	1 7 2	10 9 14	0 6 9	2 4 11
Difference, .	99 3 16	11 8 12	5 11 3	0 8 10	5 2 16	0 0 18	0 0 19

Water Consumed by the Cow in 24 hours.

	lbs. oz.
With the potatoes, ...	23 12
With the hay, ...	2 9
Taken as drink, ...	132 0
Total consumed, ...	158 5

Water Voided by the Cow in 24 hours.

	lbs. oz.
With the excrements, ...	53 10
With the urine, ...	15 14
With the milk, ...	16 3
Total voided, ...	85 11
Water consumed, ...	158 5
Water passed off by pulmonary and cutaneous transpiration, ...	72 10

The foregoing tables must be taken as comparative, depending on the breeds, sizes, forms, and styles of the animals fed, for the proportion of food they consume.

In the tables, we perceive a large loss of water, carbon, hydrogen, etc. Nearly all this loss of carbon and hydrogen escaped by respiration, while most of the water, oxygen, nitrogen and salts, passed off in perspiration. In further illustration of the subject of respiration, Liebig says, "from the accurate determination of the quantity of carbon daily taken into the system in the food, as well as of that proportion of it which passes out of the body in the fœces and urine, *unburned*, that is, in some form uncombined with oxygen, it appears that an adult, taking moderate exercise, consumes 13.9 ounces of carbon daily." The foregoing are facts in the animal economy, capable of vast practical bearing in the management of our domestic animals. But before

following out these principles to their application, let us briefly examine

THE EFFECTS OF RESPIRATION.

We have seen from the experiment of Boussingault, that there is a loss of six pounds and six ounces of carbon, and eight ounces of hydrogen in the food of the horse, and something less in that of the cow, every twenty-four hours, which has not been left in the system, nor has it escaped by the evacuations. What has become of so large an amount of solid matter? It has escaped through the lungs and been converted into air. The carbon and hydrogen of the food have undergone those various transformations, which are peculiar to the animal economy, digestion, assimilation, etc., which it is not necessary, nor will our limits permit us here to explain; and they appear at last in the veinous blood, which in the course of its circulation, is brought into the cells of the lungs. The air inhaled, is sent through every part of their innumerable meshes, and is there separated from the blood, only by the delicate tissues or membranes which enclose it. A portion of the carbon and hydrogen escape from the blood into the air cells, and at the instant of their contact with the air, they effect a chemical union with its oxygen, forming carbonic acid and the vapor of water, which is then expired, and a fresh supply of oxygen is inhaled. This operation is again repeated, through every successive moment of the animal existence. Besides other purposes which it is probably designed to subserve, but which have hitherto eluded the keenest research of chemical physiology, one obvious result of it is; the elevation of the temperature of the animal system. By the ever operating laws of nature, this chemical union of two bodies in the formation of a third, disengages latent heat, which taking place in contact with the blood, is by it, diffused throughout the whole frame. The effect is precisely analogous to the combustion of fuel, oils, etc., in the open air.

Perspiration is the counteracting agent which modifies this result, and prevents the injurious effects which, under exposure

to great external heat, would insure certain destruction. And this too, it will have been seen, is provided at the expense of the animal food. When from excessive heat, caused by violent exercise or otherwise, by which respiration is accelerated, and the animal temperature becomes elevated, the papillæ of the skin pour the limpid fluid through their innumerable ducts, which in its conversion into vapor, seize upon the animal heat and remove it from the system, producing that delicious coolness so grateful to the laboring man and beast in a sultry summer's day. These two opposing principles, like the antagonistic operations of the regulator in mechanics, keep up a perfect balance in the vital machine, and enable the entire division of the animal creation, distinguished as warm blooded, including man and the brute, all the feathered tribes, the whale, the seal, the walrus, etc., to maintain an equilibrium of temperature, whether under the equator or the poles, on the peaks of Chimborazo, the burning sands of Zahara, or plunged in the depths of the Arctic ocean.

The connection between the size of the lungs, and the aptitude of animals to fatten, will be more apparent from the fact, that the carbon and hydrogen which are abstracted, constitute two of the only three elements of fat. The larger size, the fuller play, and the greater activity of the lungs, by exhausting more of the materials of fat, must necessarily diminish its formation in the animal system; unless it can be shown, which has never yet been done, that the removal of a portion of the fat-forming principles accelerates the assimilation of the remainder.

The food which supplies respiration in the herbiverous animals, after they are deprived of the milk which furnishes it in abundance, is the starch, gum, sugar, vegetable fats and oils, which exist in vegetables, grain and roots which they consume; and in certain cases where there is a deficiency of other food, it is sparingly furnished in woody and cellular fibre. All these substances constitute the principal part of dry vegetable food, and are made up of these elements, *which in starch, gum, cane sugar and cellular fibre, exists in precisely the same proportions,* viz.: 44 per cent.

of carbon, 6.2 of hydrogen and 49.8 of oxygen. Grape sugar, woody fibre, and vegetable and animal fats and oils, are made up of the same elements, but in different proportions, the last containing much more carbon and hydrogen than those above specified. In the fattening animals, it is supposed the vegetable fats and oils are immediately transferred to the fat cells, undergoing only such slight modification as perfectly adapts them to the animal economy, while respiration is supplied by the other enumerated vegetable matters.

If these last are taken into the stomach beyond the necessary demand for its object, they, too, are converted by the animal functions into fat, and are stored up in the system for future use. But if the supply of the latter is insufficient for respiration, it first appropriates the vegetable fat contained in the food; if this is deficient, it draws on the accumulated stores of animal fat already secreted in the system, and when these two are exhausted, it seizes upon what is contained in the tissues and muscle. When the animal commences drawing upon its own resources for the support of its vital functions, deterioration begins; and, if long continued, great emaciation succeeds, which is soon followed by starvation and death. The carniverous animals are furnished with their respiratory excretions from the animal fat and fibre which exist in their food, and which the herbivoræ had previously abstracted from the vegetable creation.

The circumstances which augment respiration are exercise, cold and an abundant supply of food. Exercise, besides exhausting the materials of fat, produces a waste of fibre and tissue, the muscular and nitrogenized parts of the animal system; and it is obvious from the foregoing principles, that cold requires a corresponding demand for carbon and hydrogen to keep up the vital warmth. The consumption of food to the fullest extent required for invigorating the frame, creates a desire for activity, and it insensibly induces full respiration. The well-fed, active man unconsciously draws a full, strong breath; while the abstemious

and the feeble unwittingly use it daintily, as if it were a choice commodity not to be lavishly expended. If the first be observed when sleep has effectually arrested volition, the expanded chest will be seen heaving with the long-drawn sonorous breath; while that of the latter will exhibit the gentle repose of the infant on its mother's breast. The difference between the food of the inhabitants of the polar and equatorial regions, is strikingly illustrative of the demands both for breathing and perspiration. The latter are almost destitute of clothing, and subsist on their light, juicy, tropical fruits, which contain scarcely twelve per cent. of carbon, yet furnish all the elements for abundant respiration; the latter are imbedded in furs, and devour gallons of train oil or its equivalent of fat, which contains nearly eighty per cent. of carbon, that is burnt up in respiration to maintain a necessary warmth. The bear retires to his den in the beginning of winter, loaded with fat, which he has accumulated from the rich, oily mast abounding in the woods in autumn. There he lies for months, snugly coiled and perfectly dormant; the thickness of his shaggy coat, his dry bed of leaves and well protected den effectually guarding him from cold, which, in addition to his want of exercise, draw slightly upon respiration to keep up the vital heat. When the stores of carbon and hydrogen contained in the fat are expended, his hunger and cold compel him to leave his winter quarters, again to wander in pursuit of food. Many of the swallow tribes, in like manner, hybernate in large hollow trees, and for months eke out a torpid, scarcely perceptible existence, independent of food. Activity and full respiration, on the return of spring, demand a support which is furnished in the myriads of flies they daily consume. The toad and frog have repeatedly been found in a torpid state, embedded in lime-stones, sand-stones and the breccias, where they were probably imprisoned for thousands of years without a morsel of food; yet when exposed to the warmth of the vital air and the stimulus of its oxygen, they have manifested all the activity of their species.

This they are enabled to sustain only by an enormous consumption of insects. Dr. Playfair states, that in an experiment made by Lord Ducie, one hundred sheep were placed in a shed, and eat twenty pounds of Swedes turnips, each, per day; and another hundred were placed in the open air, and eat twenty-five pounds per day; yet the former, which had one-fifth less food, weighed, after a few weeks, three pounds more per head than the latter. He then fed five sheep in the open air, between the twenty-first of November and first of December. They consumed ninety pounds of food per day, the temperature being at forty-four degrees; and, at the end of this time, they weighed two pounds less than when first exposed. Five sheep were then placed under a shed, and allowed to run about in a temperature of forty-nine degrees. At first, they consumed eighty-two pounds per day; then seventy pounds, and at the end of the time they had gained twenty-three pounds. Again, five sheep were placed under a shed, as before, and not allowed to take any exercise. They eat, at first, sixty-four pounds of food per day; then fifty-eight pounds, and increased in weight thirty pounds. Lastly, five sheep were kept quiet and covered, and in the dark. They eat three-fifths pounds per day, and increased eight pounds.

Mr. Childers states that eighty Leicester sheep, in the open field, consumed fifty baskets of cut turnips per day, besides oil cake. On putting them in a shed, they were immediately able to consume only thirty baskets, and soon after but twenty-five, being only half the quantity required before, and yet they fattened as rapidly as when eating the largest quantity. The minimum of food, then, required for the support of animals, is attained when closely confined in a warm, dark shelter; and the maximum, when running at large, exposed to all weathers.

THE FOOD OF ANIMALS

Should be regulated by a variety of considerations. The young which may be destined for maturity, should be supplied

with milk from the dam until weaning time. No food can be substituted for the well-filled udder of the parent, which is so safe, healthful and nutritious. If, from any cause, there is deficiency or total privation, it must be made up by that kind of food, meal gruel, etc., which, in composition, approaches nearest in quality to the milk. At a more advanced age, or the time for weaning, grass, hay, roots, or grain may be substituted, in quantities sufficient to maintain a steady, but *not a forced growth.* Stuffing can only be tolerated in animals which are speedily destined for the slaughter. Alternately improving and falling back is injurious to any animal. Especially is high feeding bad for breeding animals. Much as starving is to be deprecated, the prejudicial effects of repletion are still greater. The calf, pig, or lamb, intended for the butcher, may be pushed forward with all possible rapidity. Horses or colts should never exceed a good working or breeding condition.

Purposes Fulfilled by Different Kinds of Food.—The objects designed to be answered by food are, to a certain extent, the same. All food is intended to meet the demands of respiration and nutrition, and fattening to a greater or less degree. But some are better suited to one object than others, and it is for the intelligent farmer to select such as are best for accomplishing his particular purposes. The very young animal requires large quantities of the phosphate of lime for the formation of bone; and this is yielded in the milk in larger proportions than from any other food. The growing animal wants bone, muscle and a certain amount of fat, and this is procured from the grasses, roots, and grain; from the former when fed alone, and from the two latter when mixed with hay or grass. Horses, cattle and sheep need hay to qualify the too watery nature of the roots and the too condensed nutritiveness of the grain. Animals that are preparing for the shambles, require vegetable oils or fat, starch, sugar, or gum. The first is contained in great abundance in flax and cotton seed, the sun-flower and many other of the mucilaginous

seeds. Indian corn is the most fattening grain. The potato contains the greatest proportion of starch, and the sugar beet has large quantities of sugar, and both consequently are good for stall-feeding.

The ripe sugar cane is perhaps the most fattening of vegetables, if we except the oily seeds and grain. The Swedes turnip is a good food to commence feeding to cattle and sheep, but where great ripeness in animals is desired, they should be followed with beets, carrots, or potatoes, and grain. The table of the average composition of the different crops, which we insert from Johnston, affords another view of the nutritive qualities of various kinds of food, before given from Boussingault, (page 208,) and from which it is principally abridged, and it will be found a valuable reference for their nutritive and fattening qualities. He says, "in drawing up this table, I have adopted the proportions of gluten, for the most part, from Boussingault. Some of them, however, appear to be very doubtful. The proportions of fatty matter are also very uncertain. With a few exceptions, those above given have been taken from Sprengel, and they are, in general, stated considerably too low. It is an interesting fact, that the proportion of fatty matter in and immediately under the husk of the grains of corn is generally much greater than in the substance of the corn itself. Thus I have found the pollard of wheat to yield more than twice as much oil as the fine flour obtained from the same sample of grain. The four portions separated by the miller from a superior sample of wheat, grown in the neighborhood of Durham, gave of oil respectively: fine flour, 1.5 per cent.; pollard, 2.4; boxings, 3.6; and bran, 3.3 per cent. Dumas states that the husk of oats sometimes yields as much as five or six per cent. of oil." The columns under starch, etc., and fatty matter, denote the value for respiration or sustaining life, and the fattening qualities; that under gluten, the capacity for yielding muscle and supporting labor; and saline matter indicates something of the proportions which are capable of being converted into bones:

	Water.	Husk or woody fibre.	Starch, gum, and sugar.	Gluten, albumen, legumin, &c.	Fatty matter.	Saline matter.
Wheat, ...	16	15	55	10 to 15	2 to 4 J.	2.0
Barley, . . .	15	15	60	12?	2.5 J.	2.0
Oats, ...	16	20	50	14.5?	5.6 J.	3.5
Rye, ...	12	10	60	14.5	3.0	1.0
Indian corn, . . .	14	15?	50	12.0	5 to 9 D.	1.5
Buckwheat, . .	16?	25?	50	14.5	0.4?	1.5
Beans, ...	16	10	40	28.0	2†	3.0
Peas, ...	13	8	50	24.0	2.8?	2.8
Potatoes, . . .	75?	5?	12?	2.25	0.3	0.8 to 1
Turnips, . . .	85	3	10	1.2	?	0.8 to 1
Carrots, ...	85	3	10	2.0	0.4	1.0
Meadow hay, . .	14	30	40	7.1	2 to 5 D.	5 to 10
Clover hay, . . .	14	25	40	9.3	3.0	9
Pea straw, . .	10 to 15	25	45	12.3	1.5	5
Oat straw, . . .	12	45	35	1.3	0.8	6
Wheat straw, . .	12 to 15	50	30	1.3	0.5	5
Barley straw, .	12 to 15	50	30	1.3	0.8	5
Rye, ...	12 to 15	45	38	1.3	0.5	3
Indian corn, do. . .	12	25	52	3.0	1.7	4

This table, it will be perceived, is far from settling the *precise* relative value of the different enumerated articles. An absolute, unchanging value can never be assumed of any one substance, as the quality of each must differ with the particular variety, the soil upon which it is grown, the character of the season, the manner of curing, and other circumstances. An approximate relative value is all that can be expected, and this we may hope ere long to obtain, from the spirit of analytical research which is now developed and in successful progress. More especially do we need these investigations with *American products*, some of which are but partially cultivated in Europe, whence we derive most of our analysis. And many which are there reared, differ widely from those produced here, as these also differ from each other. What, for instance, is the character of *meadow hay?* We know that this varies as four to one, according to the particular kinds grown; and *our* Indian corn has certainly a less range than from five to nine.

THE CHANGES IN THE FOOD OF ANIMALS.—Potatoes when first ripe, are estimated to be worth for feeding purposes, nearly

twice as much as when old; and we have seen that the relative value of the different kinds varies greatly at the same age, and under similar conditions of growth. Perrault ascertained by careful experiment, that hay, clover and lucern lost much of their nutritive qualities by drying, and in lucern this loss amounted to about thirty-five per cent. This is an important consideration in the feeding of green and dry forage. Oats are among the best feed, both for young and working animals; but it is found that they are greatly improved for the latter, and perhaps for both, by allowing the new crop to remain till the latter part of winter before feeding.

The improvement by steaming and cooking food has been alluded to in a previous chapter. Food properly managed, can never be made worse by cooking for any animals, although it has not been considered so essential for working, and generally for ruminating animals, as for swine, and such as were stall-feeding. But the alteration produced in cooking, by fitting it for a more ready assimilation, must as a general rule, add much to the value of the food, and the rapid improvement of the animal. The effect of slight fermentation or souring the food, produces the same result. Animals accustomed to this acid food, will reject what is unprepared when they can get at the former; and we have no doubt, from our own experience, that there is a saving in thus preparing it, from 20 to 40 per cent. A mixture of food should be supplied to all animals. Like man, they tire of any constant aliment. For such, especially, as are fattening, and which it is desirable to mature with the greatest rapidity, a careful indulgence of their appetite should be studied, and it should be provided with whatever it most craves, if it be adapted to the secretion of fat. Cutting, crushing and grinding the food; cooking, souring and mixing it, are each by themselves an improvement in feeding, and frequently two or more of these preparations combined, are of great utility in effecting the object proposed.

THE PROFIT OF FEEDING, it is evident, consists in a valuable return from the animal of the food consumed. In the horse, this

can only be received in labor or breeding; in the ox, from labor and flesh; in the cow, from the milk, the flesh and her young. In the sheep, it may be returned in its fleece, its carcass or its progeny; and in the swine, only by its progeny and flesh. The manure we expect from all, and if this be not secured and judiciously used, few animals about the farm will be found to yield a satisfactory profit for their food and attention; though it is evident, it should form but a small part of the return looked for. Animals are only profitable to the farmer when they yield a daily income, as in its milk or labor, or annually, by its young or fleece, unless it be in a course of regular improvement, either in its ordinary growth or preparation for the butcher. The animal must consume a certain amount of food merely to keep up its stationary condition, and to supply the materials for waste, respiration, perspiration and the evacuations. These must first be provided for in all cases, before the farmer can expect anything for the food.

Frequent observation has shown that an ox will consume about 2 per cent. of his weight of hay per day, to maintain his condition. If put to moderate labor, an increase of this quantity, to 3 per cent., will enable him to perform his work and still maintain his flesh. If to be fattened, he requires about 4½ per cent. of his weight daily, in nutritious food. A cow to remain stationary and give no milk, eats 2 per cent. of her weight daily, and if in milk, she will consume 3 per cent. If these statements are correct, which it is certain they are in principle, though they may not be entirely in degree, it will require the same food to keep three yoke of cattle in idleness, as two at work, and the food of every two that are idle, will nearly support one under the most rapid condition of fattening. Two cows may be kept in milk with the same feed that will keep three without.

No practice is more impolitic, than barely to sustain the stock through the winter, or a part of the year, as is the case in too many instances, and allow them to improve only when turned on grass in summer. Besides subjecting them to the risk of disease,

consequent upon their privation of food, nearly half the year is lost in their use, or in maturing them for profitable disposal, when if one-third of the stock had been sold, the remainder would have been kept in a rapidly improving condition, and at three years of age, they would probably be of equal value as otherwise at five or six. It is true that breed has much to do with this rapid advancement, but breed is useless without food to develop and mature it.

CHAPTER XV.

NEAT, OR HORNED CATTLE.

The value of our neat cattle exceeds that of any other of the domestic animals in the United States, and they are as widely disseminated and more generally useful. Like the sheep and all our domestic brutes, they have been so long and so entirely subject to the control of man, that their original type is unknown. They have been allowed entire freedom from all human direction or restraint for hundreds of years, on the boundless pampas of South America, Mexico and elsewhere; but when permitted to resume that natural condition, by which both plants and animals approximate in character to their original head, they have scarcely deviated in any respect from the domestic herds from which they are descended. From this it may be inferred, that our present races do not differ in any of their essential features and characteristics from the original stock.

VARIOUS DOMESTIC BREEDS.

Cultivation, feed and climate, have much to do in determining the form, size and character of cattle. Every country, and almost every district, has its peculiar breeds, which by long association have become adapted to the food and circumstances of its position, and when found profitable, they should be exchanged for others, only after the most thorough trial of superior fitness for the particular location, in those proposed to be introduced. More attention has been paid to the improvement of the various breeds of cattle in England than in any other country; and it is there they have attained the greatest perfection in form and character, for the various purposes to

which they are devoted. We have derived directly from Great Britain, not only the parent stock from which nearly all of our cattle are descended, but also most of those fresh importations, to which we have looked for improvement on the present race of animals. A few choice Dutch cattle, generally black and white, and of large size, good forms and good milkers, with a decided tendency to fatten, have been occasionally introduced among us, but not in any considerable numbers.

NATIVE CATTLE.—This is a favorite term with Americans, and comprehends everything in the country excepting such as are of a pure and distinct breed. It embraces some of the best, some of the worst, and some of almost every variety, shape, color and character of the bovine race. The designation has no farther meaning, than that they are indigenous to the soil, and do not belong to any well defined or distinct variety. The best native cattle of the Union, are undoubtedly to be found in the North-eastern States. Most of the early emigrant cattle in that section were from the southern part of England, and though not bearing a close resemblance to any particular English breed, unless it has been impressed upon them by more recent importations, yet a large number have that general approximation in character, features and color, which entitles them to claim a kindred with one or another of the better breeds there. They have been so promiscuously interbred that most of their original characteristics are lost, and an amalgamation of their good, bad, or indifferent qualities, have become diffused into their present condition.

Of the *native* cattle we need not further speak, as they abound everywhere, and their various qualities are well known; but as they evidently need improvement by an infusion of better, and foreign distinct breeds among them, the principal varieties of those introduced here for that purpose will be named.

THE DEVONS.

This beautiful race is claimed, in England, their native country, where only in Europe they are bred in any considerable

numbers, to be *aboriginal* in blood, being known there before the time of the Roman invasion, in the early centuries of the Christian era. They are of medium size, red in color, symmetrical in shape, and of great beauty in appearance, combining almost every good quality demanded in the bovine race. They have been kept and cultivated for many centuries in the south-western counties of England—more in Devonshire than elsewhere—and much improved in form and early ripeness within the last century. They were brought into America probably among the early importations of cattle by the Massachusetts colonies. We have no accounts of their having been distinctly bred by themselves, and they became soon lost in the miscellaneous admixtures which prevailed among all the early importations. Yet, their blood and characteristics were strong, and they gave tone and style to many of the predominating herds in various sections of the country, where their taking appearance made them favorites as *working oxen.*

They are fine in the bone, round and long in the carcass, wide in the hips, short in the leg, straight and broad in the back, fine in the head and neck, deep in the chest and brisket, prominent in the eye, high and spreading in the horn, and yellow in the muzzle—taken altogether, of most graceful and blood-like appearance. They are naturally excellent milkers, giving a medium quantity, and of remarkably good quality, yielding the richest butter. It is but just to say, however, that the English breeders of them, within the last century, have bred them more with a view to flesh and early maturity as beef cattle than for the dairy, in which symmetry in form, early ripeness, and choicer meat has been obtained at the expense of their dairy qualities. Yet among the thorough-bred herds in the United States, where attention has been paid to the milk development, they have proved well in that particular.

A few small herds of pure Devons were imported into the United States early in the present century. Those have since been added to by several new importations into several of the Eastern States, down to a quite recent date, and been bred in their

purity, and of a quality quite equal, probably, to their original ancestry in England. Their beef is of the best quality, and for working oxen they excel almost any others, being quick and sprightly in action, docile in temper, easily matched in color and movement. Yet with all their good qualities, they have not, of late, been so generally sought and appreciated as their merits demand, as tastes and fashions change, in cattle, as in some other commodities. But for hilly and medium soils, no cattle are better fitted, as a profitable stock, for the farmer. We decidedly recommend them, from long experience in their keeping, as a valuable and profitable race.

THE HEREFORDS.

This is another valuable breed, of great antiquity in some of the western counties of England, bordering on Wales, of which Herefordshire is the chief, and from which the cattle take their name. They have been bred there, time immemorial, with a distinctive character altogether their own, and are claimed by their breeders and advocates to have an origin as distinct and pure as any other breed. In England they are highly esteemed as among the best of the beef producing breeds, in early maturity, and a profitable carcass, and hold a sharp competition and rivalry with even the best of other breeds for the shambles. As working oxen they are unsurpassed. As a dairy cow, the Hereford is less esteemed, not running to milk so well as the Devons, and some of the other more common dairy breeds.

They were probably early imported, with other cattle, to America, but, like them, became lost in the general diffusion of their blood with them. Their size is large, their color red, with white or mottled faces, sometimes white backs and bellies, and occasionally a deep roan of red and white intermixed on their bodies. In *general shape* they are much like the Devons, a fourth larger in size, somewhat coarser in the bone, and hardly so refined and graceful in the outline. Their horns are high and spreading. So far as tried in America, as a beef animal they mature early, as

at three to four years they are well grown for fattening. As a working ox no beast can be better, being large, strong, readily matched, docile, and of great strength—taken altogether, the best of working cattle.

Several herds of pure Herefords have been imported here within thirty years past; successfully bred, and scattered. They have been well approved, as a grazier's beast, fitted to our medium soils, and profitable. Several good herds now exist among us, but we regret to say they are not sought by our leading cattle breeders with the avidity to which, by their actual merits, they are entitled.

THE AYRSHIRES.

This is perhaps the most popular breed of *milk* cows now in Scotland, taking their name from the county of Ayr, where they were first originated and bred, and obtained their celebrity. Their origin is of recent date, being within the last hundred years, and made up from the original Scotch *Kyloe* cow, by a cross of bulls obtained from the north-eastern counties of England, mainly, so far as our investigations have proved, the Short-horns, the older original families of which were known as excellent milkers. The history of these various crosses is too much involved in obscurity to trace it thoroughly within our limited pages; but as they are now a well established breed of great merit in their lacteal qualities, and widely disseminated in Scotland, England and America as dairy cattle, their history is of less consequence than the *fact* of their decided excellence for the pail. They may now be considered as an established *dairy* breed, capable of perpetuating, in their own blood alone, their excellent qualities. As such, they are now bred, cherished, and valued.

In size they are medium, compared with our native cattle; in color, dark red, or brown and white, occasionally inclining to roan, sometimes flecked, or spotted, the red and white variously intermingling. Their shape is usually good, being squarely built, short in the leg, broader behind than before, as all good milkers

should be, straight in the back, wide across the hips, finely shaped udder with the milk marks well developed, and bounteous milkers. Their heads are small, the horns short and well set, the eye bright, the nose either dark or yellow, but the dark usually prevailing,—altogether a satisfactory dairy cow.

They were first imported into America in the year 1822, and many more about 1830, when they readily established a good reputation as milkers. Frequent importations, and in considerable numbers, have since been made, and they have been bred and multiplied with a care evincing the value accorded to them by those who best knew their good properties. They are fitted to our medium soils and rougher lands, being active in movement, docile in temper, and grazing where some of the heavier and more sluggish breeds would not so well flourish.

As a beef or laboring animal they have been but little sought or tried. That the quality of their flesh may be good—equal perhaps to others—we have no reason to doubt, although our opportunities to judge them have been limited. As a laboring ox they have really had no trial. Their demand, hitherto, for breeding purposes, has been too active to admit of thorough trials for either flesh or labor.

THE POLLED CATTLE, OR GALLOWAYS,

Of Scotland, have been recently introduced into Upper Canada (now Ontario,) by several of the Scotch farmers there. They are a beef animal chiefly, the cows having little reputation in their native land as milkers. They are of medium size only, mostly black in color, although occasionally red, dun, or black and red brindled, compact in shape, and *hornless*. They are hardy, easy keepers, early matured, and of excellent quality for flesh. They thrive well on rough soils and in a severe climate, and may, on some of our leaner lands, yet obtain a considerable celebrity. Some of their partial breeders and advocates contend that they are good milkers, but such is not their usual reputation. For the lighter labor uses they have proved good working oxen.

THE SHORT-HORNS.

This is the most universally popular foreign breed in our country. Their large size, full development, and excellent general qualities, have made them universal favorites on all good soils where abundant grasses prevail. They have great size, great length, breadth, and depth of carcass, small in bone, fine in symmetry, attractive in color, which is red, and white, wholly, or of those colors in patches, or agreeably intermingling through all degrees and shades of roan. They are fine in the head, clean in the neck, with yellow noses, bright eyes, small, short, curved horns, and of elegant, imposing contour. They mature early, at three to four years old, and make a quick and profitable return of their food in either milk, or beef, for either of which purposes they may be profitably bred and used, as selections are made, or these qualities are required. As working oxen exclusively, we do not recommend them, as they are heavier and slower in movement than some of the other breeds, or even our native cattle.

They are of ancient origin, and until early in the present century never known, to any extent, only in a few of the Northeastern counties of England. In their present improved condition they were imported to America, only so late as the earlier years of the present century. But since their good qualities have become more known and approved, frequent and valuable importations have been made of the best blood, and they have been bred and scattered throughout the country, with an assiduity pertaining to no other foreign breed, and promising a popularity among our cattle breeders and farmers, on the richer soils, which is likely to become permanent.

When bred for that purpose, they have proved excellent milkers, and for quantity of flesh to the carcass they are superior as a beef producing animal. Yet, in their pure blood, and kept solely for breeding, they require good care to keep them up to their best condition, in quality and appearance, as, indeed do all other *good* cattle, of any established breeds.

THE ALDERNEYS, OR JERSEYS,

Are a choice, small race, giving a moderate quantity of very rich, creamy milk, much prized by families who choose to indulge in the rarest luxury of its kind. They are natives of the Channel Islands of Britain, lying off the coast of Normandy in France, where they are reared and kept in the highest perfection. In size they are small, and in shape lean, ragged, and angular, as compared with the Devons, or Short-horns. Their heads are small, yet symmetrical, with black muzzles, mealy faces, bright, prominent eyes, dishing or slightly concave forehead, light, short, crooked horns, and thin necks. Their shoulders are high and narrow, they are thin in the chest, large in the belly, somewhat depressed in the back, high and well-spread in the hips, thin in the thighs. The udder and teats are well shaped and delicate, giving a moderate quantity—say eight to twelve quarts a day of the richest, yellowest milk, and yielding more butter to a given quantity than any other race of cows known. Their colors are usually fawn and white, or "squirrel grey," prettily blended, and sometimes a smoky, or deep brown hue, and occasionally black and white mottled. They have a peculiarly *blood*-like appearance, and of distinct characteristics from any other breed. They are docile in disposition, not so hardy to withstand the severe vicissitudes of our climates as some others, yet great favorites with those who properly appreciate and carefully use them. They are rapidly increasing in popularity, particularly in the neighborhood of our large towns and cities,—indeed some of our tasteful lovers of this race of *bovines*, jocularly assert that the ownership of one or more Alderneys is necessary to constitute a *finished* "country gentleman."

As a beef producing, or working ox, the Alderney is in little request, their forms not being fitted to excel in the one, nor their muscular form sufficient for the strength of the other. Still they are a most useful and desirable breed for the purposes to which they are applied.

THE DUTCH CATTLE, OR HOLSTEINS.

This valuable dairy breed has lately been introduced from Holland into the neighborhood of Boston, Mass. They are of large size, black and white in color, and in shape somewhat resemble the Short-horns. They have evidently been bred in their own original blood, for a long time, perhaps for centuries, in their native homes, the dairy districts of North Holland, and been carefully improved with a view to develop their lacteal qualities. Their trial, as a dairy cow, has thus far been most successful, as they show all the prominent points of great milkers, both in quantity and quality. We have seen some fine specimens of them, and have no doubt of their value in making up one of the most useful of our dairy varieties, on good soils, and under proper treatment, as well as for labor, and beef. We hope to see them thoroughly distributed and successful throughout the country.

There is still another race of hardy, rugged little cattle which we hope yet to see introduced into America, as being wonderfully well fitted to our mountainous regions of country, and the wild, high plains of the Western States and Territories. It is the "West Highland" breed of Scotland. They have there bred and flourished, time immemorial. They are of little value for milk, but their flesh is superior to any known breed in Britain.

MANAGEMENT OF CALVES.

The safest and least troublesome manner of raising calves, is at the udder of the dam; and whenever the milk is not converted into butter and cheese, we believe this to be the most economical. The milk of one good cow is sufficient, with a run of fresh, sweet pasture, to the feeding of two calves at the same time, and if we allow the calves to arrive at three or four months of age before weaning, we may safely estimate, that one good cow will yield a quantity of milk in one season fully equivalent to bringing up four calves to the weaning age. By keeping the calf on the fresh

milk, whether he take it directly from the udder, or warm from the pail, all risk of disordered bowels is avoided. The milk is precisely adapted to the perfect health and thrift of the young, and whenever we substitute for it any other food, we must watch carefully that not the slightest mismanagement produces disorder, lest more be lost by disease or want of improvement, than is gained by the milk of which they are robbed. The calf, or calves, should never run at large with the cow, but always be confined in a yard or grass paddock, until thoroughly weaned, when they may be turned to pasture, apart from the cow.

The first milk of the cow, after calving, is slightly purgative, which is essential to cleanse the stomach of the calf. It is moreover of little value, for two or three days, for any other purposes except for swine. The calf will seldom take all the milk at first, and whatever is left in the bag should be thoroughly removed by the hand. If the calf is destined for the butcher, he must have all the milk he wants for at least six weeks, and eight or ten is better; and if the cow does not furnish enough, he ought to be fed Indian, barley, pea, or oat meal gruel, or linseed tea. He should be closely confined in a snug, but clean and airy stable, and the darker this is, and the more quiet he is kept, the more readily he will fatten. If designed to be reared, the safest and least troublesome method is to keep the calf on new milk. If saving the milk be an object, it is still doubtful whether it is not better that he should have a part of it fresh from the cow, and depend for his remaining food on a good grass or clover pasture, meal or roots. Some farmers never allow the calf to approach the dam, but take it when first dropped, and put a handful of salt in its mouth, which is daily repeated till he is put to grass. This has a purgative effect, similar to the first milk. Flax-seed is then prepared by boiling a pint in four to six quarts of water, and diluted with hay tea till rather thicker than milk, and fed at blood heat. It is a much better plan, however, to let the calf suckle the cow for two or three days, until the fœtal matter from the intestines has fully passed off. Its nursing is

soothing to the udder of its dam, and altogether the best and most *natural* way of starting the calf into a healthy growth. As the calf becomes older, oat, barley, rye, or Indian meal may be scalded and added to the flax-seed. A better way when the skim milk is of little consequence, is to withdraw him from the cow after three or four days, then scald the milk, adding a little oat meal, and cool to the natural temperature of the milk, and feed it. Oats, either crushed or ground, is the best and safest grain for all young stock. The milk should not stand more than half a day before feeding to young calves. As they advance in age, it may be fed rather older, but should never be allowed to become sour; nor should it ever be fed cold. Connected with this feed should be a good range of short, sweet pasture, and shelter against both sun and storms. If expedient, at about twelve weeks old, he may be safely weaned, but four months' nursing is better for the calf. If allowed only milk for several months, without grass or other coarser food, it is injurious to the future development of the young. Milk alone does not distend the stomach properly, nor call into use its ruminating habits. Calves thus brought up, have often proved light-bellied, indifferent feeders, and decidedly inferior animals. When the calf is removed from the cow, they should be effectually separated from sight and hearing, as recognition creates uneasiness, and is an impediment to thrift in both. If there be any deficiency of suitable pasture for the calf, a small rack and trough should be placed under the shed in his range, and fine hay put in the former, and wheat bran or oat meal, with a little salt, in the latter. It is also well to have resin within its reach, and if inclined to scour, add a little rennet to its food; if costive, administer pork broth. For disordered bowels, mix 2 dr. rhubarb, 2 oz. castor oil, and ½ dr. ginger, with a little warm milk or gruel; or give 2 oz. castor oil alone, or 3 oz. of Epsom salts. Calves, like all young stock, should be allowed to change their feed gradually, from new milk to skimmed, or from the latter to other food. Their stomachs are delicate, and need gentle,

moderate changes, when necessary to make them at all. Much depends on the care and attention they receive. A comfortable shelter, with a dry, warm bed, suitable food, regularly given three times a day at blood heat, and keeping the stomach in proper order, will do much to bring them forward rapidly, and with a small expenditure of food. The calf may grow faster if supplied through the winter with an abundance of fine, sweet hay and roots, the latter either chopped or mashed by a roller, with the addition of a trifle of meal or oats, and a weekly supply of salt, and pure water daily. When there are larger animals on the premises, the calves ought to be kept by themselves. They should be sustained on their winter feed the following spring, until the grass furnishes a good bite on a well-compacted sod. The change from hay to grass must be gradual, unless the latter is considerably matured. The extreme relaxation of the bowels from the sudden change, frequently produces excessive purging. A slight and temporary relax from the early spring grass is not objectionable.

Time of Breeding.—The young animals should never be put to breeding under fifteen months old, so as to bring their first calf at two years old; nor then, unless they have large size and good feed. Much depends on the progress towards maturity, and the supply of food, in selecting the proper time for breeding. Some are as ready for this at a year and a half as others are at three. Early breeding gives delicacy and symmetry to the form of the heifer, but it checks its growth, and when it is found to put her back too much, she may be allowed to rest for a few months, or even a year, to bring her up to the desired standard. These remarks apply principally to choice breeding, or as it is some times termed, *fancy stock*. For ordinary milk cows which have been moderately fed, two to three years, according to the size and growth they attain, is a proper age to come in, after which they must be milked as regularly and as late before drying as possible.

Breaking Steers should be commenced when two or three years old. Some begin with the calf, accustoming him to a light

yoke and occasional training. This practice will do as a pastime for trustworthy boys, as it makes them gentle and manageable afterwards, but is hardly worth a man's time. If always carefully handled when young, they will be found tractable. They should at first be placed behind a pair of well-broke cattle, and should not be put to hard labor until quite grown, strong and perfectly accustomed to the yoke. If properly managed, cattle may be trained with all the docility, intelligence, and much of the activity of the horse. That they are not, is more frequently the fault of their masters.

Management of Oxen.—To procure perfect working cattle, it is necessary to begin with the proper breed. Many parts of the country will furnish such as are well suited to this purpose. A strong dash of Devon or Hereford blood is desirable when it needs to be improved. A well-formed, compact, muscular body; clean, sinewy limbs; strong, dense bones; large, well-formed joints, with a mild, expressive eye, are essential for good working oxen. After breaking, they must be led along gently, and taught before they are required to perform their task, and never put to a load which they cannot readily move, nor dulled by prolonged exertion beyond that point when it becomes irksome. A generous diet is necessary to keep up the spirit and ability of cattle, when there is hard work to be done. The horse and mule are fed with their daily rations of grain, when at hard service, and if the spirit of the ox is to be maintained, he should be equally well fed, when as fully employed. Great and permanent injury is the result of niggardly feeding and severe toil, exacted from the uncomplaining animal. His strength declines, his spirit flags, and, if this treatment be continued, he rapidly becomes the stupid, moping brute, which is shown off in degrading contrast to the more spirited horse that performs, it may be, one-half the labor on twice his rations. The ox should be as little abused by threats and whipping, as by stinted feed and overtasked labor. Loud and repeated halloing, or the severe use of the lash, is as impolitic as it it is cruel and disgraceful. We never witness this barbarity without wishing the brutes could change places long

enough at least to teach the biped that humanity, by his own sufferings, which his reason and sensibility have failed to inspire. Clear and intelligible, yet low and gentle words, are all that are necessary to guide the well-trained, spirited ox. The stick, or whip, is needed rather to indicate the precise movement desired, than as a stimulant or means of punishment. The ox understands a moderate tone more perfectly than a boisterous one; for all sounds become indistinct as they augment. He loses his sensitiveness as the driver's voice increases, till at last he becomes almost as brutal. It is of great advantage to have oxen well trained to *backing*. They may soon be taught by beginning with an empty cart on a descent; then on a level; then with an increasing load, or up hill, till the cattle will back nearly the same load they will draw. Some oxen have a bad trick of *hauling* or *crowding*. Changing to opposite sides, longer or shorter yokes, and, more than all, gentle treatment, are the only remedies, and those not unfrequently fail. Cattle will seldom contract this habit, in the hands of a judicious, careful driver. *The yokes* should be carefully made and set easy, and the bows fitted to the necks and properly attached to the yoke. Cattle are liable to sore necks if used in a storm, and, when subject to this exposure, they must be well rubbed with grease, where the yoke chafes them, and respite from work should be allowed till the necks heal.

The Proper Time for Fattening Cattle, must depend on their previous feeding and management, the breed, and the purposes required. The improved breeds and many of their crosses will mature for the butcher as fully at three or four, as inferior cattle at five to seven years old. If pushed rapidly with proper food, they will of course be *ripe* much sooner than if stinted. When cattle have to be purchased for work, or cows for the dairy, it becomes an object to keep them as long as they can be made profitable, and yet be turned off for fattening at a fair price. We have seen active and spirited oxen in the yoke at twelve or fourteen; but they seldom do as well after eight or ten years. Old cattle are liable to more diseases than young, are less

hardy, and recover more slowly when exposed to scanty feed or hard usage. They also fatten with more difficulty, and their meat is inferior. When they can be sold advantageously to the feeder, and replaced without inconvenience, it is found to be most profitable to turn them off at seven or eight years. They will by that time have attained full maturity; they will feed rapidly, and make the largest amount of good beef. If there are extraordinary milkers among the cows, or first-rate workers among the oxen, it is better to keep them as long as they maintain their full vigor.

Such as are designed for the shambles the ensuing fall or winter, may be allowed to do their spring's labor; or, if cows, they may be milked into summer after calving, or go farrow during the previous year. They should early be put on the best summer feed, which is better to be occasionally changed, to give variety and freshness, and keep the animal in good appetite. Let the fattening animals have the best, and after they have cropped it a while, give them a fresh field, and the younger cattle, or sheep, can follow and clear off the remaining herbage, preparatory to shutting it up for a new growth. Some prefer an extensive range of rich feed, which is unchanged throughout the season, and when it is not necessary to divide the pasture with the other animals, this is the best practice.

The selection of animals for stall fattening is a nice point, and none without a practiced eye and touch, can choose such as will make the best return for the food consumed. The characteristics of choice animals heretofore enumerated, are particularly essential in those intended for profitable fattening. But the most important of all is that firm mellowness, and quick elasticity of touch, which unerringly marks the kindly feeder and profitable bullock. When other means for ascertaining fail, it is a safe rule to select the best conditioned animals, out of a herd of grass fed; for if all were of equal flesh and health, when turned out, those which have thriven most on their summer pasture, will generally fatten quickest on their fall and winter keep. Only the best should be selected. The remainder, after consuming the coarses

forage, may be at once disposed of for early use. From repeated trials in those districts where grain bears a high price, it is found that the carcass of stall-fed animals will barely return the value of the materials consumed, and their manure is generally the only compensation for the time and attention bestowed. None but choice, thrifty beasts will pay for their food and attention, and all others will make their best returns, by an immediate disposal after the surplus fodder is gone.

Stall-feeding ought to be commenced early in the season. An ox may be fed in a box stall, or if accustomed to a mate, they do better by tying together with sufficient room to lie down, yet not so near as to allow of injuring each other. The building should be warm, but not hot; well ventilated, yet having no current of cold air passing through; and as dark as possible. The stall ought to be kept clean and dry, and a deep bed of clean straw is of decided advantage. The ox should be first fed the inferior and most perishable roots with his grain and dry forage, and his food should be gradually increased in richness as he advances towards maturity. The food and water should be given twice a day, from thoroughly cleaned mangers or troughs. The animal likes a change of food, in which he should be indulged as often as may be necessary. If he refuses his food, a temporary privation, or variety is essential. When the food is changed, he should be moderately fed at first, till he becomes accustomed to it, as there is otherwise danger of cloying, which is always injurious. The moment the animal has done feeding, the remainder of the food ought to be at once removed. He then lies down, and if undisturbed, rests quietly till the proper hour induces him again to look for his accustomed rations. Regularity in the time of feeding, is of the utmost consequence. An animal soon becomes habituated to a certain hour, and if it be delayed beyond this, he is restless and impatient, which are serious obstacles to speedy fattening.

CHAPTER XVI.

THE DAIRY.

Cows for the Dairy.—From what has been said on the various characteristics of the different breeds of cattle, it must be evident, that no very definite criteria of excellence can be given for all good dairy cows. But there are certain points in a good milker that can hardly be mistaken. She should be descended from the best milking stock; her head should be small, or of medium size; muzzle fine and nostrils flexible and expanded; face long, slender and dishing; cheeks thin; eyes full, mild and prominent; horns delicate and waxy, and they may be either branching, lopped, crumpled, or absent; long, thin, lively ear, rather thinly haired on the inside; neck thin and small at its junction with the head; deep chest, but not too heavy before; back level and broad; well ribbed; belly large; low flank; wide thighs, but thin; short legs, and standing well apart; large milking veins; loose, capacious udder, rather square in form, coming well out behind; good teats; loose, mellow skin, of a yellow shade; and a fine, thick coat of glossy hair; and she must be of a good disposition, and free from tricks. Yet, with all the skill of a well practiced taste in the selection of animals, the dairyman will frequently find his theories and results at sad variance. One may sometimes select a fine animal, with every appearance of good milking qualities, which is but a medium cow at the pail; and another, that hardly seems worthy of notice, and which sets at defiance many established milking points and all preconceived notions of symmetry, may yet prove a good milker. A cow that runs to flesh while in milk, is generally an indifferent animal for the dairy. Perfec-

tion in a cow, consists in converting all she eats into milk while yielding it, and when dry, in turning all she consumes into valuable meat.

Management of Dairy Cows.—A cow may have her first calf when between two and three years of age, according to her size and developments. After calving, if in cold weather, or not at pasture, she should be fed twice a day a pail full of warm water, with two or three quarts of light meal or bran in it, in addition to a moderate supply of her common food for two or three days. Avoid fat in a breeding cow. Too high feeding is the cause of milk fever, caked bag, garget, and a host of evils; and too poor feed is almost equally objectionable. The average time of a cow with young is from forty to forty-one weeks; but they sometimes go only thirty-four, and occasionally overrun forty-four. A dry, unoccupied stall or yard is best for her to calve in; and if there is any serious delay or difficulty in the operation, she may be assisted by placing the fœtus in the right position, and gently pulling it with every throe of the dam. After the calf has drawn all he wants at morning and evening, the bag should be thoroughly and quickly emptied of all the milk. If strong and vigorous, the calf is the best doctor for garget or caked bag. He may be allowed to suck the cow or not, at the option of the owner· there are reasons for and against the practice, as will be seen under the head of raising calves, and each person must determine in his own case, on which side the balance lies.

Milking.—This is an important operation, and on its proper performance depends much of the success of the dairyman. The work should be done in a stable if it can be, the cows tied, or stanchioned as in their winter feeding, thus keeping them orderly and not exposed to storms, as when milked in a yard. A cow regularly, gently, yet quickly and thoroughly milked, will give much more than if neglected. The same milkers should milk the same cows daily if possible. They get used to each other, and both milker and cows are the better for it. If a herd of cows

be separated into two divisions, each yielding the same quantity of milk, and one is given to a good milker, and the other to a shiftless or lazy one, the latter will speedily reduce his milk much below the quantity obtained by the former; and if the milkers then exchange cows, they will be found to change quantity, too; those before affording the least soon giving the most. An indifferent milker ought never to be tolerated in a herd; good ones are cheaper at double the price. It is best to milk at intervals of about twelve hours, which may be done when pastures are convenient, or cows are soiled or fed in the yard. But as this is not often the case, they should be milked early in the morning and turned into pasture, to fill themselves before the sun is oppressive; and if they are to be kept up at night, let them browse in the pasture as long as possible before they are brought to the yard or stable.

MILK

Is produced from the females of all the warm-blooded animals which are enumerated among the mammaliæ. The milk of several animals is employed for domestic purposes, among different nations. That of the camel is used by the Arabs; the milk of the ass by the Spaniards, the Maltese, and the inhabitants of the Levant; that of the mare by the Cossacks, the Kirgheez, and other Tartars; and that of the goat, the ewe and the cow by most of the ancient, and, with few exceptions, by every modern European nation. Within the last century, however, the use of all, excepting cow's milk, has been almost entirely discarded among the most highly civilized people. The cow is the only animal which is employed in America for producing milk, excepting in the vicinity of some of our large cities, where the goat is sometimes used by foreign emigrants. For milk uses, the cow is preeminently fitted, and the modern improvement of this invaluable animal, has carried her product of milk almost as far as can be reasonably looked for from a given amount of food; and although this is of about the average richness of the goat and ewe, and before that of the ass, the quantity she yields is

frequently as eight to one in favor of the cow over the first two competitors. As a milk-giving animal, the cow is the best fitted for the purposes of civilized man, and she is made to contribute, not only to his health, his comfort and his economy, but to many of his choicest luxuries. Milk contains every element of nutrition necessary to animal existence; and man *can* subsist with unimpaired health, if limited to this food alone.

THE CONSTITUENTS OF MILK are butter, which varies from 2 to 6 per cent.; casein or cheese, usually 4 to 5, but sometimes varying from 3 to 15 per cent.; (the last excessive quantity yielded only by the first milk after calving;) milk sugar, 4 to 6; salts or saline matter, 0.2 to 0.6; and water, 80 to 89.

There is much diversity in the product and quality of milk from cows of the same breed, the same food, and other circumstances and conditions apparently equal. Thus, of a herd of twenty-two, one gave 84 quarts in one week, which afforded 3½ pounds of butter; two others, in the same time, gave 86, yielding 5½ pounds; and a fourth gave 88 quarts, making 7 pounds. The amount of butter, however, which a given quantity of milk will produce, is not the only criterion of the value of the milk, except for this purpose alone. Some cows will yield more butter, others will produce more cheese; while, for consumption, another may partially compensate, in the increased quantity of milk-sugar and the saline matters, for a deficiency of both the other ingredients. But for dairy purposes, butter and cheese are the only measure of the value of milk; and a cow is esteemed good or indifferent as she gives one or the other in the greatest abundance.

CIRCUMSTANCES WHICH MODIFY THE QUANTITY AND CHARACTER OF MILK.—Besides the accidental variation in the quantity and quality of milk in different animals before adverted to, there are many reliable causes which influence both. Of these, parentage has a most decided and uniform influence, frequently modified, however, in the particular individual, by some personal and controlling causes. But a cow whose maternal ancestry on both sides are choice milkers, is almost certain to resemble them.

Food influences the quantity rather than the quality. Boussingault tried numerous experiments, with cows fed on various kinds of food, and found the difference hardly appreciable in the quality of milk. Its true benefit is to be looked for, in the increased quantity, through which the valuable ingredients are distributed in nearly the same proportion, as when the product is materially lessened. By quality we mean to be understood, the amount of the ingredients, valuable for nutrition only; for it is certain, that there is a rich aromatic flavor, not only in milk, but in butter and cheese, which is afforded in various articles of food, and especially by the fresh green herbage which abounds in the pastures from spring to autumn. Activity or rest has a great effect on both quantity and quality. The less action and the more quiet and rest, the greater the amount of milk and butter. But exercise is absolutely essential to the production of cheese. Butter may be made from cows confined in a stable, but cheese can only be profitably made by animals at pasture, or by *soiling* on green food. It is supposed by physiologists, that the exercise in gathering their food, rather than any peculiarity in its character, is necessary to convert the nitrogenized tissues into the nitrogenized principle of caseum or cheese. The time from calving, has also its effect. The first milk drawn from a cow after calving, has been found to yield over fifteen per cent. of casein, while in its ordinary state it gives only three to five and a-half. As the quantity of milk diminishes in a farrow cow, the quality improves within certain limits. Pregnancy affects the quality injuriously, and especially towards its latter stages; and a cow that is predisposed to giving milk, should be dried off a few weeks before its expiration, as it is then unfit for use. Fat cows give poorer milk than such as are moderately lean; and young animals do not come up to the maximum of their quality, till after their third or fourth calving. The milk first drawn from the udder, will yield less proportion of cream, than the strippings; and the milk which is drawn three times a day, is greatly inferior to such as is taken but once, though the latter is less abundant. As a rule, the milk

should be drawn twice during the twenty-four hours. Excitement, or fretfulness; change of locality, or to a different herd with new companions; separation from her calf; periodical heat; annoyance from flies, or worry from dogs; exposure to storms, severe cold, or an oppressive sun; and many similar causes, diminish the quantity of milk.

Dr. Playfair found that the quantity of butter in the evening milk, after the cow had been at pasture all day, was 3.7 per cent., while the casein was 5.4; after lying quietly all night, the milk from the same cow on the following morning, contained 5.6 per cent. of butter, and only 3.9 of casein. In stabling the cow, the butter was invariably in greater proportion than when allowed to ramble in the pasture; and the casein with a single exception, was equally diminished.

Cream.—If milk be immediately set away in shallow vessels, after being taken from the cow, the cream rises to the surface, and carries with it most of the butter contained in the milk, and along with it much of its casein. Hence the great nutritive properties of butter-milk, which retains the casein in very large proportions, much of it being rejected by the butter in its separation from the cream. A temperature below 34°, will prevent the cream from rising in any considerable quantity, and preserve the milk unaltered for some weeks. Coagulating the milk from any cause, will equally prevent the separation of the cream. The elevation of temperature within certain limits, hastens the separation. Thus, at 50°, the cream will mostly have risen in 36 hours; at 55°, in 24; at 68°, in 18 or 20, and at 77°, in 10 or 12 hours. Heating the milk near the boiling point, and then setting it away and allowing it to remain undisturbed, will soon cause the cream to rise. In the celebrated Orange dairy, near Baltimore, Md., this system was practiced, by which, not only most of the cream was secured for butter, but in consequence of its rapid separation, the skimmed milk was sent to market apparently fresh; and the scalding imparted to it an agreeable flavor and apparent richness, which it did not really possess. We do not advise this practice where the sale of *fresh* milk is an object.

BUTTER.

Sour Cream.—Cream, for the purpose of churning, is usually allowed to become sour. It ought to be at least one day old, but may with advantage be kept several days in cool weather—if it be previously well freed from milk and be frequently stirred to keep it from curdling. This sour cream is put into the churn and worked in the usual way till the butter separates. This is collected into lumps, well beat and squeezed free from the milk, and in some dairies is washed with pure cold water as long as the water is rendered milky. In other localities the butter is not washed, but, after being well beat, is carefully freed from the remaining milk by repeated squeezings and dryings with a clean cloth. Both methods, no doubt, have their advantages. In the same circumstances the washed butter may be more easily preserved in the fresh state, while the unwashed butter will probably possess a higher flavor.

Sweet Cream may be put into the churn and the butter be obtained, but in most cases it requires more labor and longer time, without, in the opinion of good judges, affording in general a finer quality of butter. In all cases the cream becomes sour during the agitation and before the butter begins distinctly to form.

Sourness of the Cream.—For the production of the best butter, it is necessary that the cream should be sufficiently sour before it is put into the churn. Butter made from sweet cream is neither good in quality nor large in quantity, and longer time is required in churning. It is an unprofitable method.

Churning the milk, with the cream upon it, when soured to thickening, is much practiced by many excellent butter makers. We do not know of any particular difference in the quality of the butter produced from it, than when the cream alone is churned.

The alleged advantages of churning the entire milk, may be thus stated. The proper temperature can be readily obtained both in winter and summer. A hundred gallons of entire milk will give in summer five per cent. more butter than the cream from the same quantity of milk will give. Butter of the best

quality can be obtained, without difficulty, both in winter and summer. No special attention to circumstances or change of method is at any time required. The churning in winter and summer is alike simple and easy. The butter is not only of the best quality while fresh, but is also best for long keeping, when properly cured or salted.

Quickness in Churning.—The more quickly milk or cream is churned, the paler, the softer, and the less rich the butter. The churning ought always to be regular, slower in warm weather that the butter may not be soft and white, and quicker in winter that the proper temperature may be kept up.

Over-Churning.—When the process of churning is continued after the full separation of the butter, it loses its fine yellowish, waxy appearance, and becomes soft and light colored. The weight of the butter, however, is said to be considerably increased.

Temperature of the Milk or Cream.—Much also depends upon the temperature of the milk or cream when the churning is commenced. Cream when put into the churn should never be warmer than 55° Fahrenheit. It rises during the churning from 4° to 10° above its original temperature. When the whole milk is churned, the temperature should be raised to 65°, which is best done by pouring in hot water into the churn *while the milk is kept in motion.* In winter, either of these temperatures may be easily attained. In cold weather it is often necessary to add hot water to the cream to raise it even to 55°. But in summer, and especially in hot weather, it is difficult, even in cool and well ordered dairies, (without the use of ice,) to keep the cream down to this comparatively low temperature. Hence, if the cream be then churned, a second rate butter, at best, is all that can be obtained.

Cleanliness is peculiarly necessary to the manufacture of good butter. Cream is remarkable for the rapidity with which it absorbs and becomes tainted by any unpleasant odors. It is very necessary that the air of the dairy should be sweet, that it should

be often renewed, and that it should be open in no direction from which bad odors can come.

The statement of J. T. Lansing, who received the first premium for butter from the New-York State Agricultural Society, is as follows:

1. The number of cows kept is ten.

2. Keep them stabled through the inclement season; feed them from three to four times per day with good hay or green stalks; when near coming in, add some oats, barley, or corn cracked. In summer, good pasture, with living water accessible at all times, and plenty of salt.

3. The treatment of milk and cream before churning, is to strain the milk in tin pans and place them in a cool cellar for the cream to rise. When sufficiently risen, separate the cream from the milk; put in stone jars, well prepared before churning.

4. The mode of churning in summer, is to rinse the churn with cold water; then turn in the cream, and add to each jar of cream put in the churn, full one-fourth of the same quantity of cold water. The churn used is a patent one, moved by hand with a crank, having paddles attached, and so constructed as to warm the milk, if too cold, with hot water, without mixing them together. The milk and cream receive the same treatment in winter as in summer; and in churning, use hot instead of cold water, if necessary.

5. The method of freeing the butter from the milk, is to wash the butter with cold water till it shows no color of the milk, by the use of a ladle.

6. In salting the butter, use the best kind of Liverpool sack salt; the quantity varies according to the state in which the butter is taken from the churn; if soft, more, if hard, less, always taking the taste for the surest guide. Add no saltpeter, nor other substances.

7. The best time for churning is the morning, in hot weather, and to keep the butter cool till put down.

8. The best mode of preserving butter in and through the summer and winter, is as follows: The vessel is a stone jar, clean

and sweet. The mode of putting it down is to put in a churning of butter, and put on strong brine; let it remain on until the next churning is ready to put down, and so on till the jar is filled; then cover it over with fine salt, the same to remain on till used.

Mr. McWilliams, of Orange county, the celebrity of whose butter is unsurpassed, thus details his method of butter making:

"Our practice is not to churn the milk until it becomes thick or loppered; the milk and cream is then churned together. The temperature of the milk is about 50 degrees. In warm weather about a quart of cold water is put in each pan before the milk is strained, so as to keep it sweet as long as possible. The cellar floor is brick. This in warm weather is daily cleansed with cold water. A drain from the cellar carries off the water thus applied. The churn is filled about half full with milk, with the addition of two pails of cold water before starting the churn. In cold weather the same quantity of warm water is applied. When the churning is finished, which usually occupies about two hours of time, there are then two more pails of cold water applied to raise the butter and cool it. The butter is then taken out of the churn and put in a large tray; this is immediately filled with cold water and the butter carefully washed; after which the water is thrown off. The butter now undergoes the process of salting, and is then placed in a cool situation where it stands about an hour, and worked carefully over. This finished it is placed in the same situation as before, where it stands three or four hours, and is again worked over; again replaced for five or six hours, when it is worked-over for the third time. It is now replaced, where it stands till the next morning and worked over for the fourth time. A small quantity of nitre is then put in the butter. Thus finished it is placed in firkins holding about eighty-five pounds. Previous to packing, the firkin is scalded with hot water, rinsed and cooled with cold water, then rubbed all around with fine salt; this prevents the butter from adhering to the sides of the firkin. When the firkin is full, a linen cloth is placed over the top of the butter; on this cloth a covering of salt is put one inch deep.

and cold water enough added to it to form a brine. It then stands till it is to be sent to market, when the cloth and salt are removed, the firkin turned down, the top of the butter in the keg washed with cold water, and the pickle drained off. The firkin is now neatly headed up and sent to market."

The salt added to the butter should be from 1-24th to 1-28th of its weight, or two-thirds of an ounce to a pound, and this must be of the best quality. All the butter-milk must be thoroughly extracted by repeated washings, and when completed, the butter should be immediately packed, and not a particle of air allowed to come in contact with it, till open for the table.

Butter factories have of late been introduced into some of the Eastern counties of New York, and worked with success. Their chief advantages are the aggregation of large quantities of milk from many farms, thus cheapening the labor and producing butter of uniform quality.

CHEESE.

The circumstances affecting the Quality of Cheese.—All cheese consists essentially of the curd mixed with a certain portion of the fatty matter, and of the sugar of milk. But differences in the quality of the milk, in the proportion in which the several constituents of milk are mixed together, or in the general mode of dairy management, give rise to varieties of cheese almost without number. Nearly every dairy district produces one or more qualities of cheese, peculiar to itself.

Natural difference in the Milk.—It is obvious that whatever gives rise to natural differences in the quality of the milk must affect also that of the cheese prepared from it. If the milk be poor in butter, so must the cheese be. If the pasture be such as to give a milk rich in cream, the cheese will partake of the same quality. If the herbage or other food affect the taste of the milk or cream, it will also modify the flavor of the cheese.

Creamed or Uncreamed Milk.—Still further differences are produced according to the proportion of cream which is left in or

is added to the milk. Thus, if cream only be employed, we have the rich *cream-cheese*, which must be eaten in a comparatively recent state. Or, if the cream of the previous night's milking be added to the new milk of the morning, we may have such cheese as the *Stilton* of England, or the small, soft, and rich *Brie* cheeses so much esteemed in France. If the entire milk only be used, we have such cheeses as the *Cheshire*, the *Double Gloucester*, the *Cheddar*, the *Wiltshire*, and the *Dunlop* cheeses of Britain, the Kinnegad cheese, I believe, of Ireland, and the Gouda and Edam cheeses of Holland. Even here, however, it makes a difference whether the warm milk from the cow is curdled alone, or whether it is mixed with the milk of the evening before. Many persons are of opinion that cream which has once been separated, can never be so well mixed again with the milk; that a portion of the fatty matter shall not flow out with the whey and render the cheese less rich. If, again, the cream of the evening's milk be removed, and the skimmed milk added to the new milk of the next morning, such cheeses are of inferior quality. If the cream be taken from *all* the milk, the cheese is still inferior to the last.

Butter-milk Cheese.—But poor or butterless cheese will also differ in quality according to the state of the milk from which it is extracted. If the new milk be allowed to stand to throw up its cream, and this be then removed in the usual way, the ordinary skimmed-milk cheese will be obtained by adding rennet to the milk. But if, instead of skimming, we allow the milk to stand till it begins to sour, and then remove the butter by churning the whole, we obtain the milk in a sour state (*butter-milk.*) From this milk the curd separates naturally by gentle heating. But being thus prepared from sour milk, and without the use of rennet, butter-milk cheese differs more or less in quality from that which is made from sweet skimmed milk. The acid in the butter-milk, especially after it has stood a day or two, is capable of coagulating new milk also, and thus, by mixing more or less sweet milk with the butter-milk, before it is warmed, several other qualities of mixed butter and sweet milk cheese may readily be

manufactured. This article is, however, of little use, only when eaten fresh, when it is a healthy and palatable food.

Whey Cheese.—The whey which separates from the curd, and especially the white whey, which is pressed out towards the last, contains a portion of curd, and not unfrequently a considerable quantity of butter, also. When the whey is heated, the curd and butter rise to the surface, and are readily skimmed off. This curd alone will often yield a cheese of excellent quality, and so rich in butter, that a very good imitation of Stilton cheese may sometimes be made with alternate layers of new milk curd and this curd of whey.

Mixtures of Vegetable Substances with the Milk.—New varieties of cheese are formed by mixing vegetable substances with the curd. A green decoction of two parts of sage leaves, one of marigold, and a little parsley, gives its color to the *green cheese* of Wiltshire; some even mix up the entire leaves with the curd. The celebrated Schalzieger cheese of Switzerland is made by crushing the skim-milk cheese, after it is several months old, to fine powder, in a mill, mixing it then with one-tenth of its weight of fine salt, and one-twentieth of the powdered leaves of the mellilot trefoil, (*trifolium melilotus cerulea*,) and afterwards with oil or butter, working the whole into a paste, which is pressed and carefully dried. The green decoction of garden sage is frequently used by American dairymen, to make the article called "sage cheese," for a variety of home consumption, but not extensively for sale.

Preparation of Rennet.—Rennet is prepared from the salted stomach or intestines of the suckling calf, the unweaned lamb, the young kid, or the young pig. In general, however, the stomach of the calf is preferred, and there are various ways of curing and preserving it. The stomach of the newly killed animal contains a quantity of curd, derived from the milk on which it has been fed. In most districts it is usual to remove, by a gentle washing, the curd and slimy matters which are present in the stomach, as they are supposed to impart a strong taste to

the cheese. The calf should have a copious draught of milk shortly before it is killed, in order that the stomach may contain a larger quantity of the valuable curd.

Salting the Stomach.—In the mode of salting the stomach similar differences prevail. Some merely put a few handfuls of salt into and around it, then roll it together, and hang it near the chimney to dry. Others salt it in a pickle for a few days, and then hang it up to dry; while others, again, pack several of them in layers, with much salt both within and without, and preserve them in a cool place till the cheese making season of the following year. They are then taken out, drained from the brine, spread upon a table, sprinkled with salt, which is rolled in with a wooden roller, and then hung up to dry. In some foreign countries, again, the recent stomach is minced very fine, mixed with some spoonfuls of salt and bread-crumb into a paste, put into a bladder, and then dried. In whatever way the stomach or intestine of the calf is prepared and preserved, the almost universal opinion seems to be, that it should be kept for ten or twelve months before it is capable of yielding the best and strongest rennet. If newer than twelve months, the rennet is thought to make the cheese heave or swell, and become full of eyes or holes.

Making the Rennet.—In making the rennet different customs also prevail. The usual way is to take the entire stomachs, and pour upon them from one to three quarts of water for each stomach, and to allow them to infuse for several days. If only one has been infused, and the rennet is intended for immediate use, the infusion requires only to be skimmed and strained. But if several be infused, as many as have been provided for the whole season, about two quarts of water are taken for each, and, after standing not more than two days, the infusion is poured off, and is completely saturated with salt. During the summer, it is constantly skimmed, and fresh salt added from time to time. Or a strong brine may at once be poured upon the skins, and the infusion, when the skins are taken out, may be kept for a length of time. Some even recommend that the liquid rennet should

not be used until it is at least two months old. When thus kept, however, it is indispensable that the water should be fully saturated with salt.

In making rennet, some use pure water only; others prefer clear whey; others a decoction of leaves, such as those of the sweet-briar, the dog-rose, and the bramble, or of aromatic herbs and flowers; while others, again, put in lemons, cloves, mace, or whisky. These various practices are adopted for the purpose of making the rennet keep better; of lessening its unpleasant smell; of preventing any unpleasant taste it may give to the curd; or, finally, of directly improving the flavor of the cheese. The acidity of the lemon will, no doubt, increase also the coagulating power of any rennet to which it may be added. The rennet thus prepared is poured into the milk, previously raised to the temperature of 90° or 95° Fahrenheit, and is intimately mixed with it. The quantity which it is necessary to add varies with the quality of the rennet, from a table-spoonful to half a pint for thirty or forty gallons of milk. The time necessary for the complete fixing of the curd varies also from fifteen minutes to an hour, or even an hour and a half. The chief causes of this variation are the temperature of the milk, and the quality and quantity of the rennet employed.

Different Qualities of Cheese.—The temperature of new or entire milk, when the rennet is added, should be raised to about 95° Fahrenheit; that of skimmed milk need not be quite so high. If the milk be warmer, the curd is hard and tough; if colder, it is soft and difficult to obtain free from the whey. When the former happens to be the case, a portion of the first whey that separates may be taken out into another vessel, allowed to cool, and then poured in again. If it prove to have been too cool, hot milk or water may be added to it; or a vessel containing hot water may be put into it before the curdling commences; or the first portion of whey that separates, may be heated and poured again upon the curd. The quality of the cheese, however, will always be more or less affected, when it happens to be necessary

to adopt any of these remedies. To make the best cheese, the true temperature should always be attained, as nearly as possible, before the rennet is added.

Mode in which the Milk is Warmed.—If, as is the case in many family dairies, the milk be warmed in brass caldrons, great care must be taken that it is not singed, or *fire-fanged.* A very slight inattention may cause this to be the case, and the taste of the cheese is sure to be more or less affected by it. It is desirable in this heating not to raise the temperature higher than is necessary, as a great heat is apt to give an oiliness to the fatty matter of the milk.

The time during which the curd stands is also of importance. It should be broken up as soon as the milk is fully coagulated. The longer it stands after this, the harder and tougher it will become.

The quality of the rennet is of much importance not only in regard to the certainty of the coagulation, but also to the flavor of the cheese.

The quantity of rennet added ought to be regulated as carefully as the temperature of the milk. Too much renders the curd tough; too little causes the loss of much time, and may permit a larger portion of the butter to separate itself from the curd. It is to be expected, also, that when rennet is used in great excess, a portion of it will remain in the curd, and will naturally affect the kind and rapidity of the changes it afterwards undergoes. Thus it is said to cause the cheese to heave or swell out from fermentation. It is probable, also, that it will affect the flavor which the cheese acquires by keeping. Thus it may be that the agreeable or unpleasant taste of the cheeses of certain districts or dairies may be less due to the quality of the pastures, or of the milk itself, than to the quantity of rennet with which it has there been customary to coagulate the milk.

The way in which the rennet is made, no less than its state of preservation and the quantity employed, may also influence the flavor or other qualities of the cheese.

The way in which the curd is treated, is usual in our best cheese districts carefully and slowly to separate the curd from the whey; not to hasten the separation, lest a larger portion of the fatty matter should be squeezed out of the curd, and the cheese should thus be rendered poorer than usual. But in some places the practice prevails of washing the curd with hot water after the whey has been partially separated from it.

The separation of the whey is part of the process upon which the qualities of the cheese in a considerable degree depends. In making the celebrated Stilton cheese, the curd is not cut or broken at all, but is pressed gently and with care till the whey gradually drains out. Thus the butter and the curd remain intermixed, and the rich cheese of Stilton is the result. Thus, while it is of importance that all the whey should be extracted from the curd, yet the quickest way may not be the best. More time and care must be bestowed in order to effect this object, the richer the cheese we wish to obtain. The quality of the milk or of the pastures may often be blamed for the deficiencies in the richness or other qualities of cheese, which are in reality due to slight but material differences in the mode of manufacturing it. *The kind of salt* used is considered by many to have some effect upon the taste of the cheese. It should be of the purest quality.

The mode in which the Salt is applied.—In making large cheeses, the dried curd, for a single cheese of sixty pounds, is broken down fine and divided into three equal portions. One of these is mingled with double the quantity of salt added to the others, and this is so put into the cheese vat, as to form the central part of the cheese. By this precaution, the after-salting on the surface is sure to penetrate deep enough to cure effectually the less salted parts. It may not be impossible to cause salt to penetrate into the very heart of a large cheese, but it cannot be easy in this way to salt the whole cheese equally, while the care and attention required must be greatly increased.

Addition of Cream or Butter to the Curd.—Another mode of improving the quality of cheese is by the addition of cream to

the dry and crumbled curd. Much diligence, however, is required fully to incorporate these, so that the cheese may be uniform throughout. Still this practice gives a peculiar character to the cheeses so manipulated.

Size of the Cheese.—From the same milk it is obvious that cheeses of different sizes, if treated in the same way, will, at the end of a given number of months, possess qualities in a considerable degree different. Hence, without supposing any inferiority, either in the milk or in the general mode of treatment, the size usually adopted for the cheeses of a particular district or dairy, may be the cause of a recognized inferiority in some quality which it is desirable that they should possess in a high degree.

The method of curing has very much influence upon the after qualities of the cheese. The care with which they are salted, the warmth of the place in which they are kept during the first two or three weeks, the temperature and closeness of the cheese room in which they are afterwards preserved, the frequency of turning, of cleaning from mold, and rubbing with butter; all these circumstances exercise a remarkable influence upon the after qualities of the cheese. Indeed, in very many instances, the high reputation of a particular dairy district or dairy farm is derived from some special attention to one or another, or to all of the apparently minor items of its process.

In the foregoing remarks, we have treated the making of cheese in a domestic way chiefly, as a *household* production. But the manufacture of cheese in our dairy districts has of late assumed such large proportions, being now mainly made in factories, that the old time manner of treating it, in all but the preparation of the essential ingredients, is thrown aside for more recent improvements, as the heating caldrons, the curd vats, and various other utensils to work the milk through its different processes into the perfectly cured cheese. It has become a trade by itself, requiring skill, experience, and apprenticeship to the work, which few can obtain outside of the regular factory.

It is fortunate for the country that it has become so, as the household labor of cheese making is extremely toilsome to the female department, and many times hazardous in the quality of its production. The perfect management of the dairy, either butter or cheese, requires a thorough and practical instruction for its full government. To all who propose cheese making as a pursuit, we commend them to an examination of the factory process, and apprenticeship to the work, or, if the latter cannot be afforded, to the employment of a competent hand, well versed in the modes of making the article at the best of these establishments.

CHAPTER XVII.

SHEEP.

With the exception of the dog, there is no one of the brute creation which exhibits the diversity of size, color, form, covering and general appearance which characterizes the sheep, and none which occupies a wider range of climate, or subsists on a greater variety of food. In every latitude between the equator and the arctic, he ranges over sterile mountains, and through the fertile valleys. He feeds on almost every species of edible forage, the cultivated grasses, clovers, cereals and roots; he browses on aromatic and bitter herbs; he crops the leaves and bark from the stunted forest shrubs, and the pungent, resinous evergreens. In some parts of Norway and Sweden, when other resources fail, he subsists on fish or flesh during their long and rigorous winters, and if reduced to necessity, he eats his own wool. He is diminutive like the Orkney, or massive like the Teeswater. He is policerate or many-horned; he has two large or small spiral horns like the Merino, or is polled or hornless like the long wooled. He has a long tail like our own breeds; a broad tail, like many of the Eastern, or a mere button of a tail, like the fat-rumps, discernible only by the touch. His coat is sometimes long and coarse, like the Lincolnshire; short and hairy, like those of Madagascar; soft and furry, like the Angola, or fine and spiral, like the silken Merino, or Saxon. Their color, either pure or fancifully mixed, varies from the white or black of our own country, to every shade of brown, dun, buff, blue and gray, like the spotted flocks of the Cape of Good Hope and other parts of Africa and Asia. This wide diversity is the result of long domestication, under almost every conceivable variety of condition.

Uses.—Among the antediluvians, sheep were immolated for sacrificial offerings, and their fleeces probably furnished them with clothing. Since the deluge, their flesh has, with all nations, been used as a favorite food for man; and by the rude, roving nations of the East, they are employed in carrying burthens. Their milk is generally used by the uncivilized, and to some extent, by the refined nations of Europe, not only as a beverage, but for making into cheese, butter and curds. Job refers to its use, as do Isaiah and other of the Old Testament writers. Most of the Greek and Roman writers describe its general use and manufacture. The ewe's milk scarcely differs in appearance from that of the cow, but is generally thicker, and yields a pale, yellowish butter, that is always soft, and soon becomes rancid. Cully remarks: "The cheese is exceedingly pungent, and for that reason is preferred by many, to that from the cow." In Wales, it is mixed with that of the dairy, and makes a tart, palatable cheese. We have never seen it appropriated for dairy purposes in the United States, except by a few Welsh and Highland emigrants. The sheep is sometimes employed in the dairy regions of this country, at the tread-mill or horizontal wheel, to pump the water, churn the milk, or perform other light domestic work; but it is rather a poor power.

The dignity and importance of the shepherd's vocation have ever been conspicuous. Abel, the supposed twin-brother of the first-born of the human race, was a "keeper of sheep;" and from this it may be fairly inferred, that there is no animal which has so long been under the immediate control of man. Abraham and his descendants, as well as most of the ancient patriarchs, were shepherds. Job had 14,000 sheep. It is said of Rachel, the favored mother of the Jewish race, "she came with her father's sheep, for she kept them." The seven daughters of the priest of Midian, "came and drew water for their father's flocks." Moses, the statesman and law-giver, who "was learned in all the wisdom of the Egyptians, kept the flocks of Jethro, his father-in-law;" and David, the future monarch of Israel, the hero, poet,

and divine, was a keeper of sheep. It was to shepherds, while "abiding in the field, keeping watch over their flocks by night," that the birth of the Saviour was announced. The root of the Hebrew name for sheep, signifies fruitfulness, abundance, plenty; as indicating the blessings they were destined to confer on the human race. With the sacred writers, they were the chosen symbol of purity and the gentler virtues; they were the victims of propitiatory sacrifices; and finally they became the type of redemption to fallen man. These may not be considered accidental allusions in a book, whose every feature is full of design. Nor has the sheep been less the subject of eulogy and attention with profane writers. Among these, Homer and Hesiod, Virgil and Theocritus, introduced them with evident delight in their pastoral themes; while their heroes and demi-gods, Hercules and Ulysses, Æneas and Numa, carefully perpetuated them throughout their regal domains. The modern English poet, Bloomfield, in one of his charming pastorals, describes the clouds,

> "Spotless as snow, and countless as they're fair,
> The beauteous semblance of a flock at rest."

In later times they have commanded the attention of the most enlightened nations; and their prosperity has in no instance been independent of those useful animals, wherever wool and its manufactures have been regarded as essential staples. Spain and Portugal, for more than two centuries, were the most enterprising nations of Europe, and during that period they excelled in the production and manufacture of wool. Flanders, for a time, was before England in the perfection of the arts and the enjoyments of life, and *England then sent the little wool she raised to that country to be manufactured.* Her politic sovereigns soon found this a losing game, and offered large bounties for the importation of artists and machinery. By a systematic and thorough course of legislation, which looked to the utmost protection and augmentation of wool and woolens, she has carried their production beyond anything the world has ever seen. The small islands of Great Britain and Ireland, in

addition to the support of their 30,000,000 of people, 15,000,000 of cattle, 2,250,000 horses, 18,000,000 swine, and innumerable smaller domestic animals, maintain 50,000,000 sheep, worth \$300,000,000; and besides manufacturing nearly all their fleeces, annually import a greater amount from abroad. The sumptuary law for burying the dead in woolen, still occupies its place in their statute book. And beyond all question, England is the leading power of Europe in the combination of all those qualities, which constitute national greatness, civilization and strength.

VARIETIES.—Naturalists have divided the wild sheep into four varieties. *The Musimon*, (*Ovis Musimon*,) inhabiting Corsica, Sardinia and other islands of the Mediterranean, the mountainous parts of Spain and Greece and some other regions bordering upon that inland sea, have been frequently domesticated and mixed with the long cultivated breeds. *The Argali*, (*O. Ammon*,) ranges over the steppes or elevated plains of Central Asia, northward and eastward to the ocean. They are larger, more hardy and more untameable than the Musimon. *The Rocky Mountain sheep*, (*O. Montano*,) frequently called the big-horn by our western hunters, is found in various flocks and large numbers throughout the wild mountainous regions, extending through California and Oregon to the Pacific. They are larger, but in other respects resemble the Argali, of which they are probably descendants, as they could cross upon the ice, at Behring's straits, from the north-eastern coast of Asia. Like the Argali, when caught young, they are easily tamed; but we are not aware that they have ever been bred with the domestic sheep. Before the country was overrun by the white man, they probably inhabited the region bordering on the Mississippi. Father Hennepin, a French Jesuit, who wrote nearly two hundred years ago, and who falsely claims to have first discovered that river, often speaks of meeting with goats, in his travels through what is now the territory embraced by Illinois and Wisconsin. The wild, clambering propensities of these animals, occupying the giddy heights, far beyond the reach of the traveler, and the outer

coating of hair, (supplied underneath however, with a thick coating of soft wool,) gives to them much of the appearance of that animal. In summer they are generally found single; but when they descend from their isolated rocky heights in winter, they are gregarious, marching in flocks under the guidance of leaders. *The Bearded sheep of Africa*, (*O. Tragelaphus*,) inhabit the mountains of Barbary and Egypt. They are covered with a soft, reddish hair, and have a mane hanging below the neck, and large locks of hair at the ankle.

THE DOMESTIC SHEEP (*Ovis Aries*,) embraces all the varieties of the subjugated species. Whether they have descended from any one of the wild races, is a question yet undetermined among the naturalists; but however this may be, many of the varieties apparently differ less from their wild namesakes than from each other. *The Fat-rumped* and *Broad-tailed sheep* are much more extensively diffused than any other. They occupy nearly all the South-eastern part of Europe, Western and Central Asia, and Northern Africa. They are supposed to be the varieties which were propagated by the patriarchs and their descendants, the Jewish race. This is inferred from various passages in the Pentateuch, Exodus xxix. 22; Leviticus, iii. 9; viii. 25; ix. 19, and some others, where "the fat and the rump" are spoken of in connection with offerings, in which the fat was always an acceptable ingredient. Dr. Boothroyd renders one of the foregoing passages, "the large fat tail entire taken clear to the rump." It is certain this variety gives indisputable evidence of remote and continued subjugation. Their long, pendent, drowsy ears, and the highly artificial posterior developments, are characteristic of no wild or recently domesticated race.

This breed consists of numerous sub-varieties, differing in all their characteristics of size, fleece, etc., with quite as many and marked shades of distinction as the modern European varieties. In Madagascar, they are covered with hair; in the south of Africa, with coarse wool; in the Levant, and along the Mediterranean, the wool is comparatively fine; and from that of the fat-

rumped sheep of Thibet, the exquisite Cashmere shawls are manufactured. Both rams and ewes are sometimes bred with horns, and sometimes without, and they exhibit a great diversity of color. Some yield a carcass of scarcely thirty pounds, while others have weighed two hundred pounds dressed. The tail or rump varies greatly, according to the purity and style of breeding; some are less than one-eighth, while others exceed one-third the entire dressed weight. The fat of the rump or tail is considered a great delicacy, and in hot climates resembles oil, and in colder, suet. The broad-tailed were brought into this country about seventy years since, by Commodore Barron and Judge Peters, and bred with the native flocks. They were called the Tunisian Mountain sheep. Some of them were subsequently distributed by Colonel Pickering, of Massachusetts, among the farmers of Pennsylvania, and their mixed descendants were highly prized as prolific and good nursers, coming early to maturity, attaining large weights of superior quality of carcass, and yielding a heavy fleece of excellent wool. The principal objection brought against them, was the difficulty of propagation, which always required the assistance of the shepherd. The lambs were dropped white, red, tawny, bluish or black; but all excepting the black, grew white as they approached maturity, retaining some spots of the original color on the cheeks and legs, and sometimes having the entire head tawny or black. The few which descended from those originally imported into this country, became blended with American flocks, and are now scarcely known. A few other importations have since been made, but have proved of little value for American cultivation.

Native or Common Sheep of the United States.—Strictly speaking, there are no sheep indigenous to North America, excepting the *Ovis Montana*, or Rocky Mountain sheep. Before the introduction of the improved European breeds, during the present century, our sheep consisted generally of a hardy, long-legged, coarse, open-fleeced animal, which yielded according to attention and feed, from one and a half to four pounds of indif-

ferent wool. We have seen numerous flocks within the last thirty years, of the old natives, whose bellies were entirely destitute of wool, and sometimes the whole carcass was bare, excepting a mere strip or ridge like a mane, reaching from the head to the tail. The wool which was retained on the neck, back and sides, was frequently matted almost as firmly as a leather apron; and that on the thighs, and sometimes on the sides, was often composed almost wholly of long hair. Although indifferently formed in comparison with the best breeds of the present day, being thin in the breast and back, light quartered, and slow in coming to maturity, they yet possessed some good qualities. They were prolific, and made excellent nurses.

There were occasionally some smutty-nosed, or brockle-faced sheep among them, distinguished by their additional size, superior merits and courage. These were usually the leaders of the flock in their marauding expeditions on their neighbor's domains, and in common with the others, were eminently adapted to purvey for themselves on the frontier settlements. There were besides, some black or dark chocolate-brown members in every flock, which were much valued by the thrifty housewife for their wool, which afforded an economical mixture for jackets, hose and trowsers, known as sheep's grey. Our original stock were principally derived from England, where their counterparts may be seen at the present day, in the refuse breeds of that country. When these sheep were well selected and properly bred, there was rapid and satisfactory improvements, and from such flocks, mixed with some of the more recently improved varieties, have sprung many valuable animals.

The Merino.—This is undoubtedly among the most ancient race of sheep extant. The loose descriptions and indefinite generalities of the ancient writers, leave much to conjecture on this point; yet we have a few passages from Pliny, Columella and some other Roman authors, which leave little doubt that the Merino was bred in their age, and had even been introduced into Italy from Greece. It is a matter of history, that the Greeks

had choice breeds of sheep at an early day, which they might have derived from Egypt, Tyre and Asia Minor, as they were intimately connected in commerce with those countries, where the woolen manufacture early reached great perfection. It is supposed that the celebrated Argonautic expedition, in quest of the golden fleece, undertaken by the Greeks nearly 1,300 years before Christ, resulted in procuring a valuable race of sheep from Colchis, in the Euxine. However this may be, it is certain that when Augustus extended his peaceful sceptre over half the known world, the Romans were in possession of some flocks, bearing fleeces of exceeding fineness and beauty. They had been reared in the province of Apulia, on the south-east coast of Italy, and were called Tarentine, from the capital of the province. Here, then, may have been one branch of the Merino family. Another is undoubtedly described by Pliny, who says, "the *red fleece Bœtica*," which comprises the modern Spanish provinces of Jaen, Cordova, Seville, Andalusia and Granada, "was of still superior quality, *and had no fellow*." All the Spanish coast on the Mediterranean, of which Bætica formed a considerable part, was early colonized by the enterprising Greeks; and this *red fleece that had no fellow*, was probably introduced by them at an early day, and by their descendants had been carried to a still higher degree of perfection than that of Apulia. Columella, the uncle of the writer on agriculture, a wealthy emigrant to Spain, from Italy, A. D. 30, carried with him some of the Tarentine sheep, and thus added to the fine-wooled sheep of Spain. These two ancient streams, united perhaps with a third, from the more ancient stock of the Euxine, (for Strabo asserts that some of the finest wooled sheep were brought from that region in his time, and sold for the enormous sum of $750,) flowed on in an uninterrupted current, over that broad country, and brought down to modern times the unrivalled race of the Merino. The limited region of Italy, overrun as it repeatedly was, during and after the times of the late Emperors, by hordes of barbarians, soon lost her pampered flocks, while the extended regions of Spain, intersected in every

direction by almost impassable mountains, could maintain their more hardy race, in defiance of revolution or change.* The conquest by the Moors of a part of those fine provinces, so far from checking, served rather to encourage the production of fine wool. They were not only enterprising, but highly skilled in the useful arts, and carried on extensive manufactories of fine woolen goods, which they exported to different countries. After their expulsion in the fifteenth century, by Ferdinand and Isabella, the Spaniards preserved these manufactures in part, and seduously cherished their fine flocks, and knowing the incomparable advantage they had in them, their sovereigns, except in a few isolated instances, strictly prohibited their exportation.

Exportation of Merinos from Spain.—History asserts that Henry VIII. of England, by permission of Charles V., imported 3,000 sheep, but of what kind is not mentioned, they having numerous varieties in Spain. If of the true Merino, it will explain the superior quality of the English middle-wools, the Ryeland, South Downs, and some others. The first well authenticated exportation of the Merino was made to Sweden in 1723, by Alstroemer, which solved the problem of their capacity for sustaining their character on rough fare and a high northern latitude. Lasteyrie, who wrote fifty years after the experiment had been tried, speaks of their improvement both in carcass and the quality and quantity of fleece. The next exportation was

* Whatever distrust may be attached to these scraps of history, which apparently establish the remote antiquity of the Merino, this much is absolutely certain, that they are a race whose qualities are inbred to an extent surpassed by no others. They have been improved in the general weight and evenness of their fleece, as in the celebrated flock of Rambouillet; in the uniform and excessive fineness of fibre, as in the Saxons, and in their form and feeding qualities in various countries; but there has never yet been deterioration either in quantity or quality of fleece or carcass, wherever transported, if supplied with suitable food and attention. Many sheep annually shed their wool, if unclipped; while the Merino retains its fleece, sometimes for five years, when allowed to remain unshorn. This, we conceive, affords conclusive evidence of long continued breeding among themselves, by which the very constitution of the wool-producing organs beneath the skin, have become permanently changed, and this property is transmitted to a great extent even among the crosses, thus marking them as an ancient and peculiar race.

made to Saxony, in 1765, and consisted of one hundred and five rams and one hundred and fourteen ewes, but from what flocks they were taken, history nowhere mentions. A second exportation to that country was made in 1778, of one hundred and ten that were variously selected from the best flocks in Spain. From these have descended the high-bred, silken-fleeced Saxons, whose wool stands confessedly without a rival.

In 1775, the Empress Maria Theresa imported three hundred Merinos into Germany, and placed them on the Imperial farm in Hungary. In 1786, an importation was made into Denmark and her provinces; and again, in 1797, another flock of three hundred was brought into the kingdom, and placed at Esserum, about eight leagues from Copenhagen. In 1786, one hundred rams and two hundred ewes were imported into Prussia, most of which were allowed to perish from disease, but their places were fully made up by later importations. The same year, four hundred ewes and rams were selected from the choicest Spanish flocks, and placed on the Royal farm of Rambouillet, in France, which laid the foundation of the celebrated flock which bears that name. A small flock of inferior animals was clandestinely procured by George III. of England, in 1788, which attracted little attention. In 1791, a small but choice flock was presented to that monarch, by the Cortes of Spain, which soon acquired high favor among many intelligent breeders. A part of these were kept pure, and their descendants furnished the superb flock of seven hundred Nigrettis, which procured for their owner, Mr. Trimmer, in 1829, the gold medal from the London Society of Arts. Others were mixed with different flocks in the kingdom, to the evident improvement of their fleeces.

The first importation of Merinos into the United States which resulted in the propagation of a pure breed,* was made by Chancellor Livingston, then minister at the Court of Versailles, who

* One or more pure Merinos were imported into Massachusetts, in the latter part of the last century, by a citizen of that State, but they were soon mixed with other sheep, and resulted in the perpetuation of no distinct flocks.

sent two choice rams and ewes from the Rambouillet flock in 1802, to Claremont, his country seat on the Hudson. In the latter part of the same year, Col. Humphreys, our minister in Spain, sent out nearly one hundred Merinos, which were followed by more numerous flocks from the same and other sources. The largest importations of the Merino, however, were made through Mr. Jarvis, of Vermont, then U. S. Consul in Spain, in 1809, and immediately thereafter. He first shipped, as he states, "200 Escurial; afterwards, 1,400 Paulars, 1,700 Aqueirres, 100 Nigrettis, and about 200 Montarcos. 2,700 Montarcos were sent out by a Spaniard and Portuguese, and about 300 Guadaloupes by others; also 200 to 300 Paulars, by Gen. Downie to Boston. Of the Montarco flock shipped by others, about 2,500 came to Boston, Providence, New York, and other ports. All were imported in the latter part of 1809–10, and early in 1811, and were the only Leonese Transhumantes, if we include Humphrey's and Livingston's, (which no doubt were of the same stock,) that were ever shipped to the United States."

Varieties of the Spanish Sheep.—Besides several other breeds of sheep in Spain, consisting of long and coarse wool and that of a medium staple, embraced under the different names of *Chorinoes*, *Choaroes* or *Chunahs*, the Merino is distinguished by two general divisions: the *Transhumantes* or traveling, and the *Estantes* or stationary flocks. The former are subdivided according to the Provinces they occupy, into Leonese, Segovian and Sorian. Many of the Estantes were of the best quality in respect to carcass, constitution and fleece, and such as were highly bred and in the hands of intelligent breeders, were not surpassed by any of the Spanish flocks. There were also many choice sheep among the Segovian and Sorian Transhumantes, but in general they were decidedly inferior to those of Leon. These last were universally regarded as the prime flocks of Spain. They comprised the Escurial, the Paular, the Nigretti, the Aqueirres or Muros, the Montarco, the Guadaloupe, Infantado and some others.

There is much contradictory testimony as to the comparative merits of the last mentioned flocks, as they were found in Spain; which is owing in part, doubtless, to the difference in the specimens subjected to examination. We subjoin some of the most reliable authorities on this subject. M. Lasteyrie, who investigated this matter closely, says: "The Guadaloupe have the most perfect form, and are likewise celebrated for the quantity and quality of their wool. The Paular bear much wool of a fine quality, but they have a more evident enlargement behind the ears, and a greater degree of *throatiness*, and the lambs have a coarse hairy appearance which is succeeded by excellent wool. The lambs of the Infantado have the same hairy coat when young. The Nigretti are the largest and strongest of all the traveling sheep in Spain." Mr. Livingston says: "The Escurial is the most perfect of all the traveling flocks in Spain; the Guada loupe for form, fineness and abundance of the fleece; the Paular, with similar fleeces, are larger bodied. Those of Castile and Leon have the largest with the finest coat. Those of Soria are small with very fine wool; and those also of Valencia which do not travel, and like the last have fine wool but of a very short staple." Mr. Jarvis, who spent many years in Spain under every advantage for studying them closely, and who imported and had since bred large numbers of them on his estate in Vermont, says: "The Paulars were undoubtedly one of the handsomest flocks in Spain. They were of middling height, round bodied, well spread, straight on the back, the neck of the bucks rising in a moderate curve from the withers to the setting on of the head, their head handsome, with aquiline curve of the nose, with short, fine glossy hair on the face, and generally hair on the legs, the skin pretty smooth, that is, not rolling up or doubling about the neck and body,* as in some other flocks; the crimp in the wool was not so short as in many other flocks, the wool was somewhat longer, but it was close and compact, and was soft and silky to the touch, and

* In this feature Mr. Jarvis' description differs from M. Lasteyrie, before mentioned.

the surface was not so much covered with gum. This flock was originally owned by the Carthusian friars of Paular, who were the best agriculturists in Spain, and was sold by that order to the Prince of Peace when he came into power. The Nigretti flock were the tallest Merinos in Spain, but were not handsomely formed, being rather flat-sided, roach-back, and the neck inclining to sink down from the withers; the wool was somewhat shorter than the Paular, and more crimped, the skin was more loose and inclined to double, and many of them were wooled on their faces and legs down to the hoofs. All the loose-skinned sheep had large dewlaps. The Aqueirres were short-legged, round, broad bodied, with loose skins, and were more wooled about their faces and legs than any other flock I ever saw; the wool was more crimped than the Paular, and less than the Nigretti, but was thick and soft. This flock formerly belonged to the Moors of Spain, and at their expulsion, was bought by the family of Aqueirres. The wool in England was known as the Muros flock, and was highly esteemed. All the bucks of these three flocks had large horns. The Escurials were about as tall as the Paulars, but not quite so round and broad, being in general rather more slight in their make; their wool was crimped, but not quite so thick as the Paular or Nigretti, nor were their skins so loose as the Nigretti and Aqueirres, nor had they so much wool on the face and legs. The Montarco bore a considerable resemblance to the Escurial. The Escurial flock had formerly belonged to the crown, but when Philip II. built the Escurial palace, he gave them to the friars, whom he placed in a convent that was attached to the palace, as a source of revenue. These four flocks were moderately gummed. The Guadaloupe flock was rather larger in the bone than the two preceding, about the same height, but not quite so handsomely formed, their wool was thick and crimped, their skins loose and doubling, their faces and legs not materially different from the two latter flocks, but in general they were more gummed than either of the other flocks. In point of fineness there was very little difference

between these six flocks, and as I have been told by well informed persons, there is very little difference in this respect among the Leonese Transhumantes in general. The Escurials, the Montarcos and the Guadaloupes were not in general so heavy horned as the other three flocks, and about one in six of the bucks were without horns."

The Rambouillet flock, of France, was founded in 1786, by Louis XVI., from a selection of four hundred of the best Spanish sheep, which were placed on the royal farm at Rambouillet. These received all the attention which intelligence and wealth could bestow, and the consequence was soon manifest in their larger size, and the increased weight and uniformity in the fineness of their fleece; the last improvement being particularly evident in the absence of the coarse wool which in many cases infested the quarters, and the jarr, or hair, which frequently abounds on the flanks, legs and thighs of the original Merino. Besides the crown flocks at Rambouillet, they are found in equal perfection on several other of the royal farms, especially those of Malmaison, Perpignan, Arles, Clermont, and some others. These flocks have been bred for hardy constitution, large carcass and heavy fleece, of as much fineness as consistent with large weights, and as uniform in quality throughout as possible. Mr. Gilbert, who was particularly familiar with them, says: "Almost all the fleeces of the rams, from two years old and upwards, weigh (unwashed) from twelve to thirteen pounds; but the mean weight, taking the rams and ewes together, has not quite attained to eight pounds, after deducting the tags and the wool of the belly." The French pound is about one-twelfth heavier than the English; but from the general custom of folding the sheep in France, feeding them in fallows and wintering them in houses, the fleece becomes very dirty. The loss in washing (fit for manufacturing,) is about 60 per cent., so that the clean fleece of the ram will average about six pounds, and that of the whole flock something under four pounds.

The first importation of the Rambouillets to this country was in 1801, by M. Dellesert, of Paris, for M. Dupont, then in New

York, and consisted of four choice rams, only one of which, Don Pedro, reached this country. He was used among the native ewes near Kingston, N. Y., for three years, and then transferred to Delaware, where he effected great improvement among the native flocks. The second was that made by the late Chancellor Livingston, before alluded to. There was another in 1840, by Mr. Collins, of Connecticut, comprising thirty select ewes and two rams. All these sheep possessed the characteristics peculiar to the variety as described. A still more recent importation has been made by Mr. Taintor, of Connecticut, during the summer of 1846, of twenty-three ewes and three bucks. We subjoin a description of these from the editor of the "American Agriculturist," New York. "The rams, though young, are the most promising animals of their breed we ever saw, and when full grown will weigh at least from 225 to 250 pounds each. One of them sheared twenty-three pounds of unwashed wool. To give an idea of the ewes, we measured them after they were shorn, and found they varied from 25½ to 29 inches in height over the withers; and lest it may be thought this superior height is attained by extra long legs, we will add, that the height of the under side of their bodies from the ground was from 9½ to 12 inches, which, according to our observation, is no greater in proportion to their size than that of good American Merino sheep. Their weights we took after being shorn. They varied from 124 to 153 pounds. Some of them were quite thin in flesh, the largest especially, which, if in fine condition and her fleece on, would weigh at least 200 pounds. Fourteen of these ewe fleeces weighed an average of 15 pounds each, unwashed."

These sheep were separated, a part of them taken into Vermont, and all bred with great care. They were wooled over the forehead and face, on the legs, even to the feet, prolific, and under good management multiplied rapidly. They had an extensive sale at high prices, and were introduced into many Merino flocks, chiefly in New York and the Western States; but it was found that their wool was coarser in fibre than the old, or Spanish

Merino stock, and they lacked in hardihood, compared with our common Merinos. After some years they gradually waned, and were superceded by the improved Vermont stock of the original importations, so that now but few of the Rambouillets, of pure blood, are to be found. Although of large size, they were coarse in figure, lacking compactness in body; yet, with these drawbacks, and but for the painstaking care which had been, and still is bestowed on the American born flocks of the old Spanish stocks, they might have secured a strong admixture of their blood in many of our present flocks.

Silesian Merinos.—Some years since, some fine importations of these were made from Silesia, in Germany, by Mr. Chamberlain, of Columbia Co., N. Y., and perhaps others in different places, although not now recollected. These have proved unsurpassed in style of carcass, fineness and good quality of wool. They are comparatively free from the crusty yolk carried by the Spanish Merinos, and evidently an improvement on many of that class of flocks. Thus far, both in breed and weight of fleece, they have proved eminently successful.

The Progress of the Merino in the United States.—Though reaching back but two-thirds of a century, the Merino flocks of this country have been very fluctuating as to their value, increase and improvement. When first introduced, they were viewed with distrust by the majority of our farmers; and it was not till after several years' experience of their paramount merits, that they were generally disseminated. But the confidence of our flock-masters having once been secured, it has never been withdrawn, and they have ever since been cherished favorites. The prices for choice Merinos rapidly increased after a few years, and Livingston states the average price for rams, in 1811, at $1,000, and some were sold at a much higher rate. This was the period of the embargo, when our infant manufactures were just starting into life; and being followed by war with the greatest commercial nation of the world, we were thrown entirely on our own resources for the supply of our woolen and other

fabrics, and wool and sheep maintained their full value till the return of peace, in 1815. The flooding of our country with foreign goods, under low duties, which succeeded this event, either broke down or effectually paralyzed our woolen manufactures, and wool, of course, felt the full weight of this crushing influence. The Merino rapidly declined in value, till its price nearly approximated to that of the native sheep. Their merits had, however, become so conspicuous, that the low prices produced a more general diffusion, and they and their crosses were thus sown broadcast over the country.

The introduction of the Saxons, in great numbers, in 1826, many of which were excessively diminutive and diseased, and their indiscriminate use with our pure-bred Merinos, was a serious interruption to the career of improvement in many of our flocks. Their mixture with the best Saxons was no further detrimental than to reduce the quantity of fleece, and to a certain extent lessen the peculiar hardiness of the original Transhumantes, which had been fully preserved by their descendants in this country. The use of well selected Saxon rams with Merino flocks was extensively practiced, and their crosses, although somewhat remote, are still retained by intelligent flock-masters, after forty years' experience, who are satisfied that they find it for their interest to continue this style of breeding. The animals being smaller, consume less, and they probably produce a quantity of wool in proportion to their food, which, from its improved and uniform quality, commands a higher price in the market. Their natures are intrinsically the same. They are only divergent streams from the same original fountain, and when again united, they readily coalesce and flow onwards, without violence or disorder.

The Merino, as might reasonably have been anticipated, when properly managed, has improved from a variety of causes. Though kept scrupulously pure in Spain, they were seldom bred with that refinement of taste, or that nice judgment which distinguishes the accomplished modern breeders. Their management

was too entirely entrusted to ignorant shepherds or careless agents to secure that close attention which is essential to improvement. The sheep had to perform a journey of several hundred miles twice in a year, to and from the distant Sierras; and it was absolutely essential that strong animals should be selected for breeding, and to secure this object, those were frequently used which were deficient in the most profitable qualities. They were also closely bred in-and-in, seldom or never departing from a particular flock to procure a fresh cross. Their wild, nomadic life, approaching nearly to that of their natural state, and their peculiarly healthful pasturage alone prevented a serious deterioration from this cause. When brought into the United States, the flocks were soon mingled with each other, and for many years past, probably, not an unmixed descendant of any distinct original flock could be traced. Abundance of appropriate food has been given them, without the labor of long and fatiguing journeys, and, lastly there has been much care used in the selection of the most profitable animals for breed. The spirit of improvement has, for some years past, been thoroughly awakened to this important branch of American husbandry, and has resulted in giving us numerous flocks of as choice sheep as the world affords, having all the elements within ourselves for its attainment.

Peculiarities of the Merino.—The prominent peculiarities of the Merino, are the abundance and fineness of its fleece, the tenacity with which it is held, its crimped or spiral form, its felting properties, and the excessive quantity of yolk, giving to it that softness which distinguishes it from all others. Their large horns are common to several other varieties. Their hoofs are sometimes singularly long, reaching six or eight inches, when allowed to grow. The horns, hoofs and wool scarcely differ in their chemical constituents, and the peculiar development of the two former is justly considered as an additional evidence of their wool-bearing properties. The yolk, in most of the sheep, forms, with the dust which adheres to it, a firm crust on the exterior, and, together with the compactness of the fleece, it offers consid-

erable resistance to the open hand on being pressed, giving the impression of rigidity. This outer covering repels the rain, the snow, and the wind, like a coat of mail, thus fitting the Merino to endure exposure better than any other sheep. On opening the crust, the wool is found of a brilliant, golden hue, sparkling with yolk, and firmly held together in masses, hardly distinguishable from the cocoon of the silkworm. The wool closely covers every part of the body, and frequently the entire legs and head, excepting a part of the face.

Another peculiarity of the Merino is its longevity. They attain a great age when properly managed, and, in healthy localities, sometimes breed till a dozen years of age. The Merino may be described, generally, as a small-boned, closely made, medium sized sheep, varying from sixty pounds of live weight for a small ewe, to one hundred and forty pounds for good sized wethers and rams, in ordinary condition. They are light in the shoulders and chest, and are, altogether, more deficient in form than the best mutton sheep. This apparent difference is materially lessened when both are denuded of their fleece, as the longer pile of the latter covers defects which would manifest themselves under the closer covering of the Merino. The quality of their flesh, although tolerable, is much inferior to that of the so-called "mutton" breeds.

Breeding Merinos.—The general principles of breeding cattle and sheep, as laid down by the most approved authorities, must be taken with some exceptions, when applied to the Merino. Good form and feeding qualities are desirable in this breed, but they are not as essential as with others. *Wool* is the great object, and if this be sufficiently fine, even and abundant, something may be abated in the perfection of form. Early maturity, so much sought after in the mutton sheep, cannot be reconciled with the great longevity and the prolonged productive powers of the Merino. We must content ourselves, therefore, with slowly engrafting such improvements on the breed as can be effected without prejudice to his other good qualities, and look to his

crosses with others for such qualities as are irreconcilable with his nature. It is considered indispensable to the improvement of the Merino, that it be not bred too young. A vigorous ewe may bring her first lamb at two years old, but it is better that it be deferred till three. The ram should never be used till his second year, and then but sparingly. From two and one-half to six years old is deemed the most vigorous age, though many may be safely used till eight or ten, and occasionally later. Both ewes and rams have been known to breed till twenty years old.

The ram should be large, stout and well made, carrying his weight as compactly as possible. The nose should be convex; the face covered with a soft, velvety hair, where not covered with wool; the eye lively and prominent; the veins near the lachrymal glands of a clear red; the horns rough; short neck; pendant dewlap not objectionable; full chest; broad shoulders; broad, level back; large quarters; tail large and well set up; good legs and sound hoofs, with a firm, easy, regular gait; the head carried high, with a look of boldness and decision, without in any degree approaching to wildness or ferocity. *The ewe* should possess these characteristics generally, with such modifications as are suited to the sex. Great care should be taken to breed from such as are most perfect in all the essential points of constitution, form and size, and weight, uniformity and fineness of fleece. The closest observation is requisite to select the best in all respects.

Excessive use of rams can never be permitted without decided injury to them and their progeny. If moderately grained before and during their use, and especially if kept up, and allowed to serve the ewes once only as they come in heat, the number may be largely increased. A vigorous ram will suffice for thirty-five to forty ewes, when running with the flock; yet his powers would not be more taxed by double or even treble this number, if admitted to each but once. If he is gentle, which he should always be, he should be stabled at night and fed with grain. If young ewes have stolen lambs, they should be taken away from

them immediately after yeaning, and the nourishment supplied to the lamb by another ewe, or the milk of a cow. The tax of nursing is nearly equal to that of gestation, and farther injury to the dam may be avoided by this practice. Merino ewes have had the reputation of being indifferent nurses in Spain. This is owing to their fatigue in traveling, and frequently to scanty pasturage, instead of any constitutional deficiency. It is a frequent practice there, to kill a part of the lambs and put one on to two ewes. This has never been found necessary in the countries where they have been transplanted, as generous feed for the dams has invariably been found entirely adequate to their support of the young.

The localities in which Merino sheep can be profitably kept in the United States, are wherever the pastures are sweet and dry, the climate not too hot, and the land not too valuable for other purposes. Wool is the great object of sheep husbandry in a large majority of the States of this country, and when sheep farms are remote from the large markets, the Merino will make the most profitable returns. In the neighborhood of cities, and in the more densely populated States, where large and fat sheep and early lambs bear a high price, the mutton sheep may be substituted.

From repeated trials in cleansing unwashed fleeces of thorough-bred Merino flocks in the United States, so as to be fitted for manufacturers' use, the yield is about 35 per cent. of clean wool; in other words, 65 per cent. of the fleece, unwashed on the sheep's back, is grease and dirt. There are some varieties, however, with less of the dark outside crust on their fleeces, which will give a larger proportion of clean wool to the gross weight.

Prices within the last few years have greatly increased for improved sheep of Vermont breeding. One, to three thousand dollars each, and even more, have been paid for rams, and fifty to five hundred dollars each for ewes. Although the animals may have been of superlative merit, such prices must be held as merely speculative. To show the vacillating spirit of our Amer-

ican sheep breeders, and flock-masters in the United States, as a matter of history: In the first year of our late civil war, 1861, the wools of our country, soon after the shearing season, sold at an average of 25 to 30 cents a pound. Soon afterwards, prices rose rapidly, until in 1862–3–4 and 5, they reached the unprecedented rates of $1.00 to $1.50 per pound, and the choice high-bred *Vermont* Merino rams sold frequently at $500 to $3,000 each; and the flocks of sheep in these years increased enormously in numbers. Soon after peace, prices gradually waned, until in 1868, both sheep and wool fell to the low prices of 1861. The *furor* had its day, and now, at this present writing—November, 1868,—large flocks of valuable sheep in the Western States are selling off at 75 cents to $1.00 a head, and slaughtered for their pelts and tallow, although wool is gradually advancing in price!

THE SAXON, like some others, is one of the varieties of the pure-bred Merino, the foundation of which was laid by an importation of some of the choicest animals into Saxony, in 1765. The great care and attention bestowed upon these sheep by the Elector, the nobility and the most intelligent farmers, soon carried them to a point of uniformity and excellence of fleece, never exceeded by the best of the original flocks. The breeders were selected with almost exclusive reference to the quality of the fleece. Great care was taken to prevent exposure throughout the year, and they were housed on every slight emergency. The consequence of this course of breeding and treatment, has been to reduce the size and weight of fleece, and partially to impair that hardiness and vigor of constitution which universally characterized the original Transhumantes. In numerous instances, this management resulted in permanent injury to the character of their flocks, which America has severely felt in several importations of worthless animals, which a too great eagerness for improvement induced her flock-masters to use with the Spanish Merinos and their descendants, as a means for this object, but which has resulted in the introduction of fatal diseases and serious deterioration in their flocks.

The first importation of Saxons into this country was made in 1823, of four good rams, two of which went to Boston and the others to Philadelphia. The next was made the following year, and consisted of seventy-five rams and ewes, which were brought to Boston and sold at public auction, and afterwards were scattered over the country. Another lot of one hundred and eighty followed to the same place, the next year, and was sold in the same manner, but at an increased price, some selling as high as $450 each. These prices excited the spirit of speculation, and the following year witnessed the importation of near 3,000, many of which were decidedly inferior. These were all thrown upon the market for the most they would command, and in many instances the sales not half covering the cost of importation, the enterprise was abandoned as a speculation or commercial operation. The late Henry D. Grove, of Hoosic, New York, a native of Germany, and a highly intelligent and thoroughly bred shepherd, accompanied some of the best early importations to this country. He selected one hundred and five choice animals for his own breeding, which he imported in 1827, and seventy more equally good in 1828, and with these he formed the flock from which he bred to the time of his decease, in 1844.* There are few, if any, pure flocks of Saxony sheep now in the United

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* The average weight of fleece from the entire flock of Mr. Grove, nearly all of which were ewes and lambs, as stated by him to the writer, in 1842, was 2 pounds 14 ounces, thoroughly washed on the sheep's back. This was realized after a short summer and winter's keep, when the quantity of hay or its equivalent did not exceed by actual weight 1¼ pounds per day, except to the ewes, which received an additional quantity just before and after lambing. This treatment was attended with no disease or loss by death, and with an increase of lambs, equalling one for every ewe.

In a flock of pure Saxony sheep owned by Mr. Smith, of Connecticut, as stated in a letter from the owner, published in the "American Shepherd," one hundred and four ewes raised one hundred and one lambs, and yielded 341 pounds of wool, which sold at seventy cents per pound. For the eighteen months preceding, he lost but three animals out of three hundred, from ordinary casualties. But some flocks do not, in good condition, average over 2 pounds per head. An importation, (May, 1846,) made by Mr. Taintor, of Connecticut, consisting of four bucks and four ewes, from the celebrated Saxon flock of Baron de Spreck, showed a size and vigor of constitution equal to any of their Merino progenitors.

States. They have proved too delicate and light of fleece for ordinary American husbandry.

It will be understood that all the above noticed varieties of *fine*-wooled sheep, belong to the ancient family of the "Spanish Merino."

The South-Down.—This valuable sheep has been known and bred for a long time on the chalky downs of England, where it has always maintained the character of a hardy animal, yielding a medium quality of wool, and furnishing mutton of a superior flavor. It was not however, till within the last ninety years, that any considerable attention was devoted to its improvement. Since that period, its fine points have been remarkably developed, which is shown in its improved size and form, and its early maturity and productiveness. The late Mr. John Ellman, of England, was the first who took them thoroughly in hand; and so eminent was his success, that he founded a flock which has been the source from which all the best blood has been since derived. His criterion of a good South-Down is as follows: "The head small and hornless; the face dark-brown or grey; the lips thin, and the space between the nose and the eyes narrow; the under jaw, or chap, fine and thin; the ears wide apart, and the forehead, and the whole space between, well covered with wool as a defence against the fly; the eye full and bright; the neck of a medium length, thin towards the head, but enlarging towards the shoulders, where it should be broad and high, and straight in its whole course above and below; the breast should be wide, deep, and projecting forwards between the fore legs, indicating a good constitution, and a disposition to thrive. Corresponding with this, the shoulders should be on a level with the back, and not too wide above; they should bow outward from the top to the breast, indicating a springing rib beneath, and leaving room for it; the ribs coming out horizontally from the spine, and extending far backward, and the last rib projecting more than the others; the back flat from the shoulders to the setting on of the tail; the loin broad and flat; the rump long and broad, and

the tail set high up and nearly on a level with the spine; the hips wide; the space between them and the last rib on either side as narrow as possible, and the ribs, generally, presenting a circular form like a barrel; the belly as straight as the back; the legs medium in length, proportionate with the body; the fore-legs straight from the breast to the foot; not bending inward at the knee, and standing far apart both before and behind; the hocks having a direction rather outward, and the twist, or the meeting of the thighs behind, being particularly full and well let down; the bones fine, yet having no appearance of weakness, and of a dark color; the belly well defended with wool, and the wool coming down before and behind to the knee, and to the hock; the wool, close, curled, and fine, and free from spiry projecting fibres."

Other breeders have commenced where Ellman left off, and have apparently pushed their improvement to its utmost capacity; and especially has this been done by Messrs. Grantham and Webb, the latter of whom, while preserving all the essential merits of the sheep, has carried the live weight of breeding rams, to two hundred pounds, and that of well fattened wethers to one hundred and fifty pounds, dressed weight. Many of the choicest animals have been imported into this country, and they are now to be found in considerable numbers in many States of the Union—probably as good as can be found in England. The wool was formerly short and used only for cloths, flannels, etc. It has been considerably lengthened in many of the late flocks, and with the improvements in the combing machinery, is now much used in England, as a combing wool. The quantity produced is nearly equal to that of the Merino flocks when well kept, varying according to the size and style of breeding, from three to six pounds of clean washed wool, which in quantity, does not differ materially from half-blood Merino, and sometimes rather exceeds it. The larger animals of course, produce fleeces of much greater weight, sometimes reaching to eight or nine pounds. The South-Down will subsist on short pasture, but well repays full

feeding. It attains early maturity, is hardy and prolific, frequently producing two at a birth. Like all highly improved English breeds, it is not a long-lived sheep. It may be considered in its prime at three. The wethers may be fattened at eighteen to thirty months, and the ewes at five to seven years, when first required as breeders. The ewes should not produce lambs until two years old.

SHROPSHIRE-DOWNS.—Under this name a larger variety of the Down sheep has of late been introduced among us. They are nearly one-third larger, and somewhat coarser than the South-Down, although descended from the same original race—the old Hampshire Downs, and probably crossed with one of the larger coarse wooled breeds of England. In quality and appearance they much resemble the South-Downs, but whether for wool and mutton purposes they are really superior, other than in their weight of carcass and fleece, is yet a question. The pure high-bred South-Down, in *flavor* and *quality*, is the choicest mutton sheep that we have, and over rolling, or hilly lands, with sweet grasses, no other breed equals them for that purpose, although in the weight of fleece, in proportion to that of the carcass, they fall behind the long wooled varieties. The Shropshire-Down partakes, to much extent, the same characteristics.

THE LONG WOOLED BREEDS.—Of these there are several in England, their native country, where they have been bred, time immemorial. Although existing under several different local names, they are now chiefly designated under those of Leicester, Cotswold, and Lincoln. They are hornless, and the largest class of sheep known, with very white, coarse, open fleeces of long fibre, valuable for combing purposes, and the manufacture of worsted goods, blankets, and other cloths, requiring great length of staple in the wool. They are also a *mutton* sheep, taking on flesh readily, with good keep, and feeding up to an enormous size of carcass, (for a sheep,) reaching, in rare instances, three hundred and eighty pounds live weight, and two hundred and fifty pounds in the dressed carcass.

In their original condition they were coarse, rangy, and leggy, yet always yielding large fleeces. Upwards of a hundred years ago the celebrated English stock breeder, Bakewell, took one of the varieties—the Leicester—in hand for improvement. He found them deficient in form, slow feeders, and late in maturity. He began by selecting the choicest individual animals of the race he could find, which possessed the essential requisites, and by good feeding and management throughout, he soon brought them up to a character widely differing from the originals with which he started. So eminent was his success, that in 1787, he let three rams for £1,250, (about $6;200,) and was offered £1,-050, (about $5,200,) for twenty ewes. Soon after this, he received the enormous price of 800 guineas, (or $4,000,) for the two-thirds use of a single ram for a season, reserving the other third for himself. He reduced the bone and offal, or worthless parts of the carcass, and increased the weight of the valuable parts, and especially their tendency to fatten and early maturity. This was effected mainly, by a nice discrimination, which has probably never been surpassed, if it has ever been equalled. He selected medium sizes for the breed, with as much evenness and perfection of form as possible, for he found that excellence and profitable feeding qualities were seldom connected with extra size, large bones, or imperfect form. He also observed the disposition to fatten in individuals, and used only such as were conspicuous in this respect. He relied more than all upon their quality of *handling** well, depending even more upon that flesh-yielding excellence than upon the most symmetrical figure. He used only the choicest rams, a little under size, while the ewes were of full medium weight. The progeny were pushed with a full supply of nutritious food, and systematically brought to early maturity. Connected with this, was his practice of *in-and-in breeding*, or breeding the parent upon the progeny, for several successive generations, which had the tendency still further tc

* The soft elastic touch of the skin and underflesh, when pressed by the fingers.

refine the bone and offal, and impress most effectually, the desirable characteristics of the race.

It is said that Bakewell carried his refining system to such an extent as partially to destroy the pro-creative powers, and was subsequently obliged to introduce new animals to reinvigorate and continue his flock. The general system of Bakewell, however, was attended with complete success. He produced a race of animals, not only far beyond what England had ever before seen, but which, in all the qualities he endeavored to establish, have not been exceeded since; and his *improved Leicesters* have come down to the present day as perfect as he left them, showing conclusively that he not only formed, but stamped the peculiarities of the breed with a permanence which yet bears witness to his genius.

THE COTSWOLD AND LINCOLN.—Other breeders were not slow in following in Bakewell's footsteps with different breeds, and the Cotswold and Lincoln, especially, have become the subjects of an equally decided improvement, while the errors of Bakewell were entirely avoided. They possess a rather more desirable robustness, approaching in some few specimens almost to coarseness, as compared with the finest Leicesters. It is contended that the Cotswolds and Lincolns are more hardy in constitution than the more refined Leicesters, but they have now become so intermingled in their various crosses, that few except experts can detect the difference between many individual sheep of one variety or the other; yet the improved Leicesters were undoubtedly resorted to, on one side, for a nucleus to their refinement. They attain as large a size and yield as great an amount of wool, of about the same value. These breeds scarcely differ more from each other than do flocks of a similar variety which have been separately bred for several generations. They are prolific, and when well fed the ewes will frequently produce two lambs at a birth, for which they provide liberally from their udder till the time for weaning. The weight of their fleece, in all these varieties, varies from six to twelve pounds clean wool per head.

Peculiarity of Long Wool and its Uses.—The striking peculiarity of the long wools is in the production of a fleece, which is perfectly adapted, by its length and the absence of the felting property, to the manufacture of worsted stuffs, bombazines, muslin de laines, etc. This is a branch of our manufactures for which we had little material that was suitable, till the introduction of the long wools; and its rapid extension within the past few years clearly shows that a large and increasing demand for this kind of wool will continue at remunerating prices. Besides its uses for combing, it is extensively manufactured into blankets, carpeting, and many other fabrics.

Their Introduction to America.—Occasional importations of the long wooled sheep were made here early in the present century, but not to such an extent as to make any sensible impression upon our native and comparatively ragged flocks. The South-Downs took an early lead in our importations of English sheep, on account of their superior mutton properties. Forty years ago the long wools came in to some extent, and as the staple of their wool has become more in demand within the last twenty years, they have been brought out in considerable numbers. The English and Scotch farmers of Upper Canada have imported them in considerable numbers, for thirty years past, and bred them in their highest quality and excellence, continually reinforced by fresh arrivals from the best English flocks. Indeed, many of the choicest long wools of the States have been obtained from the Canadian border. Within a very few years, however, several choice breeding animals have been selected from the best English flocks, by our own enterprising breeders, at prices indicating the high estimate placed upon them there; sums ranging as high as $500 to $1,000 have been paid for individual animals brought to the United States. These liberal selections have been induced not only for their superiority in flesh, but for the growing demand for their fleeces, and their value for the improvement of our own domestic flocks in those properties. It is not assuming too much to say that now, in both the United States and Canada,

are to be found numerous long wooled sheep of equal quality and value with any in Great Britain.

Breeding.—Like the South-Down, the long wooled ewe should not breed till nineteen months old, to bring her first lamb at two years. They are prolific, frequently bearing twins, and are usually good nurses. It is hardly necessary to remark that the most perfect rams should be selected as stock getters, and not bred until at least eighteen or twenty months old, and for their first breeding season used sparingly. Not more than fifty ewes should be served by a young ram, and it is better that he be confined with but a few at a time, and his breast be marked with powdered red chalk mixed with oil, that his service may be shown. Let in among a large flock, when several ewes are in heat together, the ram often confines his attention to a single ewe for several continuous services, thus exhausting his vigor for no benefit, and to the exclusion of others, when, by proper attention, he could serve many. It is better, indeed, unless rams be plenty, that he be separated from the flock at night, put in a stable and well fed on grain or other hearty food, as a quart of oats and good hay, or its equivalent in ground Indian corn meal, both night and morning. In such case, a ewe not in heat, or a wether or two, should be put with him, as, without company, he may not feed or drink well, being continually uneasy when alone.

The ewe goes with young about five months, varying from 145 to 162 days. Each flock-master will of course determine what is the proper time for his lambs to come. For early market, or when there are few sheep, and those well looked after, they may come while the ewes are in the yards, and provision can be made for the progeny, by placing such as are heavy, in warm stalls. Both the dam and young thus receive a closer attention than they would in the field; and after a week's housing in severe weather, the lamb may be turned out into the dry yard, where he will suffer no more, apparently, than the full grown sheep. But with large flocks, early lambing is attended with much trouble, and it is generally avoided, by deferring it till the weather has become

more settled, and a full bite of grass will afford the dam a plentiful supply of milk. Yet in this case, the young sheep must daily be under the eye of the shepherd, who should see that they are well supplied with food, and especially that they are brought under cover in severe or stormy weather.

A ram will serve from twenty to one hundred ewes in a season, according to his age, health, feed, and management. A South-Down or Long-Wool lamb of seven or eight months, is sometimes used of necessity here, and when this is done, he should be well fed, and allowed to run only with a very few ewes. If full grown rams are turned into a lean pasture to remain with the ewes, not less than four should be put in for every hundred. But if a well-fed ram, in full health and vigor, is kept up, and led out to the ewe as she comes into heat, and allowed to serve her once only, he will suffice for one hundred, without injury to himself or progeny. For this purpose the ram should be prepared, not by being fat, for this, neither he nor the ewe should ever be; but by being fed with grain for a short time before and during the continuance of the season. The ewes are more likely to come quickly into heat, and prove prolific, if lightly fed with stimulating food at the time. It is reasonably enough conjectured, that if procreation and the first period of gestation takes place in cold weather, the fœtus will subsequently be fitted for the climate which rules during the early stages of its existence. If this be so, and it is certainly in accordance with the laws of nature, fine wooled sheep are most likely to maintain their excellence, by deferring the connection of the male till the commencement of cold weather; and in the northern states, this is done about the first of December, which brings the yeaning time in the last of April or first of May, when the early grass will afford a good quality of feed.

Pure-bred sheep of different character, as the Long-Wools and the South-Downs, or Merinos, should not be crossed or bred upon each other except for mutton purposes, as such crosses for breeding uses are almost worthless, giving no *distinctness* of character

tc their progeny, even when such progeny are used for crossing on inferior varieties. The object of every flock-master, whether he breed for mutton or for wool, if they be of an inferior race or quality, should be to raise the quality of his sheep. The Merino, if kept at all, should be for wool, as the main object, and let the mutton, if mutton be made of them at all, take care of itself. *They are not a mutton sheep*, compared with either of the proper mutton breeds. Yet if the owner of them wants to turn them into that line, the South-Down ram only, of the mutton breeds, should be used, as the larger Long-Wool rams make too violent a cross, by their great size, on the diminutive carcasses of the others. We have bred very passable mutton sheep in such way, but would prefer the coarse native ewes, even for such an object.

The South-Down *ewe* should never be put to a Long-Wool ram. The ewe, compact in form, and closely built, has not sufficient room for a proper growth of the larger fœtus, and is subject to great danger in yeaning. But reverse the order—the South-Down ram to the Long-Wool ewe—such crossing, for *mutton* purposes, may be made to great advantage. Her larger breadth and size gives ample space to the expansion and growth of the fœtus, and a fine and perfect lamb is the product. So also may the open, coarser boned common ewe be bred to either the Long-Wool or South-Down ram, her elastic frame yielding to the expansion of the larger fœtus sufficiently to give it good growth and nourishment. Two or three continuous crosses in this way, breeding up the ewes thus produced to thorough-bred rams, soon gives the essential qualities, both in fleece and flesh, of the full blood to the ascending progeny. We have so bred them for many years, getting up very good sheep from the most execrable beginnings, on almost worthless common ewes, in two or three generations. For market lambs, perhaps no more profitable way can be practiced than to obtain as good common ewes as may be selected, at a low price, using thorough-bred rams of either the South-Down or Long-Wool breeds for the purpose. The common ewes are generally good nurses, and after the lambs are dis-

posed of, the ewes may be tolerably fatted in good pastures for winter mutton, or still kept over for further breeding. Such breeding, for market lambs, is a profitable business in the vicinity of good markets, and may be followed to advantage.

Where mutton is in demand, and bears a good price, sheep feeding is profitable—*if of the mutton varieties.* But they should be chiefly fatted on grass. A lean sheep, when going into winter quarters, can never pay for making flesh on grain and hay. If of proper breed, he may be fed the season after two years old, and turned off to better profit than when kept longer.

Winter Management and Food.—Sheep should be brought into winter quarters soon after the severe frosts occur, as these diminish the feed and materially impair its nutritious qualities. They ought also to be removed from the grass lands before they become permanently softened by the rains, as they will injuriously affect their comfort and health; and it is equally objectionable from their poaching the sod. If the number be large when brought to the yards, they must be carefully divided into flocks of one hundred or less, according to the size of the yards and sheds. The young and feeble must be separated from the others, and the ailing ones placed by themselves, and that no one may suffer from the others, all should be classed as uniformly as possible, as to strength. The yards must be dry, well supplied with a trough of fresh water, and with comfortable sheds to which they can retire when they choose. In snowy winters, if water be not handy, snow will supply its place quite well.

Shelters in northern climates are indispensable to profitable sheep raising, and in every latitude north of the Gulf of Mexico, they would be advantageous. There is policy as well as humanity in the practice. An animal eats much less when thus protected; he is more thrifty, less liable to disease, and his manure is richer and more abundant. The feeding may be done in the open yard in clear weather, and under cover in severe storms. The shelters for sheep are variously constructed, to suit the taste or circum-

stances of the flock-master. Sheep barns built upon a side hill will afford underground floors, surrounded by three sides of wall and opening to the south, with sliding or swinging doors to guard against storms, and sufficient storage for the fodder may be made by scaffolds; or they may be constructed with twelve or fifteen feet posts, on level ground, allowing them to occupy the lower part, with the fodder stored above. In all cases, however, *thorough ventilation should be provided*, for of the two evils of exposure to cold or too great privation of air, the former is to be preferred. Sheep cannot long endure close confinement without injury. In all ordinary weather, a shed, closely boarded on three sides, with a close roof, is sufficient protection, especially if the open side is shielded from bleak winds, or leads into a well enclosed yard. If the apartment above is used for storage, the floors should be made tight, that no hay, chaff or dust can fall upon the fleece.

Racks or Mangers are indispensable to economical feeding. If the hay is fed on the ground, the leaves and seeds, the most valuable part of the fodder, are almost wholly lost, and when wet, the sheep, in their restlessness while feeding, will tread much of it into the mud. To make an economical box or rack, take six light pieces of scantling, say three inches square, one for each corner, and one for the center of each side. Boards of pine or hemlock, twelve or fifteen feet long and twelve or fourteen inches wide, may then be nailed on to the bottom of the posts for the sides, which are separated by similar boards at the ends, two and one-half feet long. Boards twelve inches wide, raised above the lower ones by a space of nine to twelve inches, are nailed on the sides and ends, which completes the rack. The edges of the opening should be made perfectly smooth, to prevent chafing the wool. The largest dimensions above given are suitable for the larger breeds, and the smallest for Merinos, and still smaller are proper for their lambs. These should be set on dry ground, or under the sheds, and they can easily be removed whenever necessary. Some prefer the racks made with slats, or

smooth, upright sticks, in the form of the usual horse rack. There is no objection to this, but it should always be accompanied by a board trough affixed to the bottom, to catch the fine hay which falls in feeding. These may be attached to the side of a building, or used double. A small lamb requires fifteen inches of space, and a large sheep two feet, for quiet, comfortable feeding, and at least this amount of room should be provided around the racks for every sheep.

TROUGHS may be variously constructed. The most economical are made with two boards of any convenient length, ten to twelve inches wide. Nail the lower side of one upon the edge of the other, fastening both into a two or three inch plank, fifteen inches long and a foot wide, notched in its upper edge in the form required.

FOOD.—There is no better food for sheep than good upland hay, composed of the clovers and nearly all the cultivated grasses. Bean and pea straw are valuable, and especially the former, which, if properly cured, they prefer to the best hay; and it is well adapted to the production of wool. All the other straws furnish a good food, and sheep will thrive on them without hay, when fed with roots or grain. *Roots* ought to be given them occasionally for a change, and especially to the ewes after lambing, if this occur before putting them on to fresh pasture. They keep the stomach properly distended, the appetite and general health good, and they render their winter forage nearly equal to their summer feed. Much grain is not suited to store sheep. It is too rich, and should be given sparingly, except to the lambs, the old ewes or feeble sheep, or to restore the rams after hard service. For the above purposes, oats are the best; and if any other grain, beans or peas are given, it should be in small quantities. When there is a deficiency of hay and roots, grain may be used with straw. But the flock ought to be so fed as to receive the same amount of nourishment throughout every part of the year. The evenness and value of the fleece depends much upon this. When the amount of nutrition is great, the wool-

secreting organs are distended, and the fiber becomes enlarged; when limited, they necessarily contract, and the fiber is small. This produces a want of trueness, which the experienced wool stapler readily detects, and does not fail to estimate against the value of the fleece. Sheep ought to have a full supply of salt, and, if accessible, sulphur, ashes, tar and clay would frequently be nibbled by them when their stomach required either. Pine or hemlock boughs are a good substitute for tar, and afford a most healthful change in the winter food of sheep. Entire cleanliness and dryness are also essential to the health of the flock. The smaller sizes of sheep may be well sustained on two and a half pounds of hay, but larger sheep will consume from three and a half to four, or even five pounds per day. Sheep, like all other animals, when exposed to cold, will consume much more than if well protected, or than during a warmer season.

The care of the ewes with young, is an important consideration, as the lamb is sometimes the only profit yielded by the flock, for when fodder is high or wool low, the fleece will barely pay for the food and attention. Pregnant ewes require the same food as at all other times, but caution is necessary to prevent injury or abortion, which is often the result of excessive fat, feebleness, or disease. The first may be remedied by spare diet, and both the last by restored health and generous food. Sudden fright, as from dogs or strange objects, long or severe journeys, great exertions, unwholesome food, blows in the region of the fœtus, and some other causes, produce abortion.

Yeaning.—Most flocks are turned into the pasture before yeaning time, and the ewe is then left to nature, which is a good practice, if she is healthy and the weather good. But a larger number of lambs will be reared by a careful oversight of the ewes and the use of proper precautions. As their time approaches, which may be known by the springing of the udder and the enlargement of the maternal parts, they should be put by themselves at night, in a warm stable, or with others in the same condition, and well looked after, late and early in the day. They

seldom need any assistance, nor should any be rendered, except in case of wrong presentation, or feebleness in expelling the fœtus. In the former case, the shepherd may apply his thumb and finger, after oiling, and push back the young, and assist in gently turning it till the nose and fore feet appear; and for the latter, only the slightest aid should be rendered, and that to help the throes of the dam.

Management of Lambs.—When lambing in the field, only a few should be together, as the young sometimes get changed, and the dams refuse to own them. This difficulty is generally obviated by holding the ewe till the lamb has sucked two or three times, or they may be shut up together, and the lamb rubbed with a little fine salt. The lamb does not require nourishment for some hours; but if the dam refuse to lick it as soon as it appears, it must be carefully wiped dry. If the weather be cold and the lamb is dropped in the field, the shepherd should be furnished with large pockets or a well-lined basket, in which it must be placed till the ewe is brought to the shed. After the first day or two, the udders ought to be completely drained of their milk, by the hand, so as to prevent swollen or caked bag. In case of deficiency of milk, the lamb may be supplied from a new milk cow, by means of a sucking bottle with an air vent, or it may draw a part of its nourishment from another ewe, which can be held while the lamb is sucking. It is sometimes necessary to substitute a foster-mother, in which case the ewe may be made to own the lamb, by milking from her udder over the lamb and under his tail, rubbing it on well; or rub the adopted lamb with the entrails and contents of the stomach of the dead lamb, or cover it with the skin. If the ewe proves a bad nurse, or it is desirable to bring the lambs forward rapidly, they may be early taught to eat boiled oats or other grain, cabbage, roots and tender hay. Lambs should be well fed, as it is important to produce size, constitution and perfection of form. The ewes and their young ought to be divided into small flocks, and have good pasture. Some careful shepherds adopt the plan of confining

their lambs, and allow them to suck two or three times a day, by which they suffer no fatigue and thrive much faster. But this is troublesome and injurious, as the exercise is essential to the health and constitution of the lamb intended for rearing. It is admissible only when they are wanted for an early market, and by those who keep sheep for this purpose, it is a common practice.

Castrating and Docking Lambs.—After selecting enough of the choicest rams for stock getters, the castrating may be performed at any time between two and six weeks old, when the lamb is in good health. A cool day should be chosen, or if warm, it must be done early in the morning. The best method is for one person to hold the lamb firmly between his arms, about breast high as he stands, while another, with a sharp knife, cuts off the lower part of the scrotum. The testicles are then drawn out till the spermatic cord is reached, which is gently pulled out and cut with a sharp knife. It is sometimes done by simply opening the scrotum, when the testicles and spermatic cord are jerked out. This, however, is a severe and cruel way, and not so safe as the other. The wound should then be rinsed with cold water, after which apply lard. The operation of docking, is by many deferred till a late period, from apprehension of too much loss of blood; but if the weather be favorable and the lamb in good condition, it may be performed at this time with the least trouble and without injury. The tail should be laid upon the plank, the person holding him in the same position as before. With one hand he draws the skin towards the body, while the other person, with a two inch chisel and mallet, strikes it off at a blow between the bone joints, leaving it one and a half to two inches long. The skin immediately slips back over the wound and is soon healed. Ewe lambs should be docked closer than the rams. To prevent flies and maggots, and assist in healing, it is well to apply an ointment composed of lard and tar, in the proportion of four pounds of the former to one quart of the latter. Spirits of turpentine is more conveniently applied, and equally good. This is also a good application for the scrotum.

The lambs should be carefully protected from cold and wet till they are perfectly well.

Tagging or Clatting, is the removal of such wool as is liable to get fouled when the sheep are turned on to the fresh pastures, and of course it should be done just before leaving their winter quarters. It is most easily accomplished by placing the animal on a low table, or a floor, or on the ground, or even standing, another person holding it, till the operation is performed. All the wool near the extremity of the sheath and the scrotum of the males, from the udder of the ewes, and from the dock, and below it, the inside of the thighs, and from the legs of the sheep, should be removed.

SUMMER MANAGEMENT.—As soon as the warm weather approaches and the grass appears, sheep become restive and impatient for the pasture. This instinct should be repressed till the ground has become thoroughly dry, and the grass has acquired substance. They ought, moreover, to be provided for the change of food, by the daily use of roots for a few days before turning out. It would also check the tendency to excessive purging, which is induced by the first spring feed, if they were housed at night, and fed for the first few days with a little sound, sweet hay. Or, if a well grown fall pasture be left the previous fall, we have found it equally good, as the sheep feed off the old grass, and the young herbage springing up through it, they gradually work from one into the other, and thus get on to their summer food without detriment. They must be provided with pure water, salt, etc., as in winter, for though they may sometimes do tolerably well without either, yet thrift and freedom from disease are cheaply secured by this slight attention. Dry, sweet pastures, and such as abound in aromatic and bitter plants, are best suited for sheep-walks. No animal, with the exception of the goat, crops so great a variety of plants. They eat many which are rejected by the horse and the ox, and which are even essential to their own wants. In this respect, they are valuable assistants to the husbandman, as they feed greedily on wild mustard,

burdocks, thistles, marsh-mallows, milk-weed and various other offending plants; and the Merino exceeds the more recent breeds in the variety of his selections. Many prepare artificial pastures for their flocks. This may be done with a number of plants. Winter rye or wheat sown early in the season, may be fed off in the fall without injury to the crop; and in the following spring the rye may be pastured till the stalks shoot up and begin to form a head. This affords an early and nutritious food. Corn may be sown broadcast or thickly in drills, and either fed off in the fields, or cut and carried to the sheep in their folds. An experiment made with white mustard for feeding sheep, is detailed under the head of that article, which shows it to be a valuable crop for this purpose. Sheep love a wide range, and when sufficient pasturage is afforded, which always should be, it is better to give them a steady feeding than to often change from dry to green, flashy food, causing them to scour.

Washing Sheep.—In most of that portion of the Union north of 40°, the washing is performed from the middle of May to the tenth of June, according to the season and climate. When the streams are *hard*, which frequently is the case in lime-stone regions, it is better to do this immediately after an abundant rain, by which the lime derived from the springs is proportionally lessened. The practice of a large majority of our farmers, is to drive their sheep to the washing ground, early in the morning of a warm day, leaving the lambs behind. The sheep are confined on the bank of the stream by a temporary enclosure, from which they are taken, and if not too heavy, are carried into water sufficiently deep to prevent their touching bottom. They are then washed by gently squeezing the fleece with the hands, after which they are led ashore, and as much of the water pressed out as possible before letting them go, as the great weight retained in the wool, frequently staggers and throws them down. A good practice is to lead the sheep into the water and saturate the fleece, after which they are taken ashore. When they commence *steaming*, they are again led into the water, and washed clean.

This insures thorough cleansing where water is pure. Others make use of a shallow boat, or scow, one end of which rests on a bold shore and the other is in deep water. The operator stands in the boat and plunges the animal over the side where the washing is performed; or it is sometimes done by sinking a tight hogshead or large box in the running water, with heavy weights, in which a man stands, and the sheep are brought or led to and from him by another person who walks on a platform reaching from the bank to the vat. Either of the last methods obviates the necessity of standing for a long time in water, by which colds, rheumatism, etc., are frequently contracted. In parts of Germany, and sometimes in this country, sheep are forced to swim across a narrow stream several times, by which the fleece is tolerably cleaned, if all the water be pressed out when they get to the land. The yolk being a saponaceous compound, not an oily matter, as is generally supposed, it readily combines with the water and passes out of the wool. An excellent practice when streams are not convenient, is to lead a small ripple of soft water into a tub. To this a little soap is added, after which the sheep are immersed and thoroughly cleansed. Perfect whiteness and purity of the fleece is readily obtained afterwards, by throwing over the sheep a jet of water. This practice has a good effect, in preventing or removing cutaneous disorders and destroying ticks or other vermin. Many good farmers object to washing sheep, from its tendency to produce colds and catarrhal affections, to which sheep are particularly subject; but it cannot well be dispensed with, as the wool is always more salable, and if carefully done, need not be attended with injury. Warm settled weather, however, is indispensable to washing with safety to the general health of the sheep.

Shearing.—The manner of shearing varies with almost every district; but as this is an art to be acquired under a skillful master, we shall omit particular details on the subject. First clip all the tags and filth, if any remains or has been accumulated after the tagging in the spring; then take off the fleece and spread it

with the outside uppermost on a smooth bench or table, and push the wool carefully together, to render it more compact; double the sides over to the center; throw the clean loose locks into the middle, and roll together from each end. This makes a smooth, dense package, which is secured by passing a stout twine one or more times around the sides and ends. All the wool from the extremities should be closely sheared and saved by itself, before dismissing the sheep, but never put up with choice fleeces. *If wounds are made*, which is sometimes the case with unskillful operators, a mixture of tar and grease ought to be applied. After shearing, such horns and hoofs as are likely to be troublesome, should be sawed and pared. The branding or marking is essential to distinguish them from other flocks, and this is done by clipping a cut of some shape, or punching a hole or holes through one or both ears, or painting on the shoulder, side or rump. A brush or marking iron is used for this latter purpose, with paint made of red lead or lamp black, to which a little spirits of turpentine is first added, and then diluted with linseed or lard oil. If the weather be cool, and especially if severe storms occur after washing or shearing, the flock should be housed. If sultry, they should have a cool, shady retreat, where they will be shielded from the flies and heat. Blisters and permanent injury to the skin and fleece, are frequently the result of such exposure. Shade trees in their pastures, contribute much to the comfort of sheep, when exposed to a blazing sun. A close examination of the skin should be made at shearing, for the detection of disease or vermin.

Smearing, or salving sheep, is a custom little practiced in this country. For cold, elevated and exposed situations, it may be necessary, and it is generally adopted in Scotland. The object is to prevent cutaneous diseases and vermin, and furnish additional warmth and protection to the fleeces of such breeds as are deficient in yolk. It is usually performed the latter part of October, but is sometimes done immediately after shearing. The mixture or salve consists of tar and butter or grease, in different proportions; one gallon of the former to twelve, or sometimes

twenty pounds, of the latter; the greater proportion of tar being required for the younger sheep, or for more exposed situations. The grease is melted over the fire, and the tar stirred in, and when sufficiently cool, it is applied to the whole body of the sheep, by carefully parting the wool and rubbing it on the skin with the fingers. The above quantity is sufficient for thirty or fifty sheep, according to their size and the character of the wool. This application is not required for fine-wooled sheep, whose fleeces are more appropriately protected by a natural secretion of yolk; and it is better to omit it in all cases, where the health and comfort of the animal do not render it absolutely essential. Mr. Stewart, an experienced Scotch shepherd, uses only tallow and train oil, mixed in equal proportions. He asserts that the improvement in the growth and quality of the wool is at least one-third, and it materially benefits the condition of the sheep We have seldom, or never, known it practiced in this country.

Weaning.—The lambs may be weaned at about three and a half to four months old. They should be put upon rich, sweet feed, but not too luxuriant; while the dams are turned upon the poorest, and so remote from their young, as to be out of sight and hearing. The ewes ought to be carefully examined after a day or two, and if necessary, the milk removed with the hand. If it continues to accumulate, the ewe may be fed on hay for a few days. When thoroughly dried off, they should have the best fare to recover condition for subsequent breeding and wintering. The fall is a critical period to lose flesh, either for sheep or lambs; and if any are found deficient, they should be at once provided for by extra feed and attention. If cold weather overtakes them poor, or in ill health, they will scarcely outlive it; or if by chance they survive, their emaciated carcass, impaired constitution, and scant fleece will illy repay the food and attention they will have cost.

The time for taking sheep from the pastures must depend on the state of the weather and food. Severe frosts destroy much of the nutriment in the grasses, and they soon after cease to

afford adequate nourishment. Long exposure to cold storms upon such lands, with such food to sustain them, will rapidly reduce their condition. The only safe rule is to transfer them to their winter quarters the first day they cease to thrive abroad. *Drafting the flock* for the purpose of ridding it of the supernumeraries, should be done at an earlier day. Such of the wethers as have attained their prime, and those ewes that have passed it, ought to be withdrawn soon after shearing, provided with the best feed, and rapidly fitted for the shambles. If they have been properly pushed on grass, they will be in good flesh by the time they are taken from it, and if not intended for stall-feeding, the sooner they are then disposed of the better. *Stall-feeding* will be lost on an ill-shaped, unthrifty beast. The perfection of form and health, and the uniform good condition which characterize the thrifty one, indicate too plainly to be misunderstood, those which will best repay the care of their owner. The selection of any indifferent animal for stall-fattening, will inevitably be attended with loss, and they had better at once be disposed of when first brought from the pasture, for the most they will bring.

MANAGEMENT OF SHEEP FOR THE PRAIRIES.—When destined for the prairies, they ought to commence the journey as early after shearing as possible. They are then disencumbered of their fleece, and do not catch and retain as much dust as when driven later. Feed is also generally better, and the roads are dry and hard. Young and healthy sheep should be selected, with early lambs; or if the latter are too young, and the distance great, they should be left and the ewes dried off. A large wagon ought to accompany the flock, to carry such as occasionally give out; or they may be disposed of whenever they become enfeebled. With good care, a hardy flock may be driven at the rate of twelve or fourteen miles a day. Constant watchfulness is requisite to keep them healthy and in good plight. One-half the expense of driving may be saved by the use of well-trained shepherd dogs. When arrived at their destination, they should, if possible, be thoroughly washed, to free them from all dirt, and

closely examined as to any diseases they may have contracted, which if discovered, should be promptly removed. A variety of suitable food and good shelter must be provided, for the autumn, winter, and spring ensuing, and every necessary attention given them. This would be necessary if indigenous to the country; how much more so, when they have just undergone a campaign, to which neither they nor their race have been accustomed.

Sheep cannot be kept on prairie lands without much care, artificial food and proper attention; and in a false system of economy, hitherto attempted by many, losses have occurred from disease and mortality in the flocks sufficient to have made ample provision for the comfort and security of twice the number saved. More especially do they require proper food and attention, after the first severe frosts set in, which wither and kill the natural grasses. By nibbling at the *fog*, (the frost bitten, dead grass,) they are inevitably subject to constipation, which a bountiful supply of roots, sulphur, etc., are alone sufficient to remove. Roots, grain and good hay, straw or cornstalks, pea or bean vines, are essential to the preservation of their health and thrift during the winter, any where north of 40°. In summer, the natural herbage is sufficient to sustain them in fine condition, till they shall have acquired a denser population of animals, when it will be found necessary to stock their meadows with the best varieties of artificial grasses.

The dry and rolling prairies seem adapted to the usual varieties of sheep introduced into the United States; and of such are the flocks made up, according to the taste or judgment of the owners. Shepherd dogs are invaluable to the owners of flocks, both as preventives against the small prairie wolf, which prowls around the flock, but which are rapidly thinning off by the settlers; and also as assistants to the shepherds in driving and herding their flocks on the open ground. The vast stretch of prairie and open lands now opening in the new States and Territories west of the Missouri river, will probably, in time, become among the most profitable sheep ranges of the United States.

SHEPHERD DOGS.

Of these there are two widely distinct breeds. One embraces the large Spanish dog and their descendants, the Mexican, and some other varieties, which are of a size, strength and courage sufficient to defend the flock against wolves or other formidable enemies. They are frequently inclined to be ferocious, and will sometimes commit depredations on the flocks themselves. They are only necessary where there is danger from wild beasts and prowling dogs, against which, if thoroughly trained, they are always an efficient protection. The smaller kind is invaluable for assisting the shepherd in bringing in his sheep, keeping them within any required compass, driving them from place to place, and giving signal of danger. There are numerous sub-varieties, of different sizes; some with long tails, others without any; some smooth-haired, but more generally shaggy or long-haired. Each of these have a natural instinct for the management of sheep, and, if properly educated, will seldom fail to answer every reasonable wish of their masters. Unless sheep are confined in small pastures, and are so familiar and manageable as to come readily at call, the use of the sheep dog will save much of the shepherd's time. He has the intelligence of a man in comprehending the wants of the shepherd, and is vastly more efficient in bringing them together, or driving on the road and keeping them separate from other flocks. Sheep soon get accustomed to them, and, without being alarmed by their presence, they learn to regard them as guides, whom they most implicitly obey. All the above varieties have been imported, and the smaller ones are now extensively bred in this country.

CHAPTER XVIII.

THE HORSE.

In nearly all ages and countries, the horse has been the devoted servant and the object of the pride and affection of man. Among the semi-civilized Tartars of middle and northern Asia, the aborigines of our remote western prairies, reaching even beyond the Rocky mountains, and some other rude nations, his flesh is used for food. Many tribes among the former use the milk for domestic purposes, and especially when fermented and changed to an unpleasantly sour and intoxicating beverage. But throughout the civilized world, with some slight exceptions, the horse is useful only for his labor. For this purpose he is pre-eminently fitted by his compact, closely knit frame; his sinewy, muscular limbs; his easy, rapid stride; his general form and entire structure and habits. He is found in his wild condition in central Asia, Siberia, and the interior of Africa, and for three hundred years he has been turned loose to follow his native instincts on the illimitable pampas of South America and the wide-spread prairies of Mexico and California. In all these regions he closely resembles the medium varieties of the domesticated horse, but, as the natural result of his freedom, he possesses more fire and spirit than any other, except the blood horse.

Arabia is generally claimed as the original native locality of the horse, and as the only source from which he is to be derived in the requisite perfection for the highest improvement of the race. But Strabo, who wrote more than eighteen hundred years ago, asserts that the horse did not then flourish in Arabia, and it was not till some centuries later that he attained any decided

superiority there. Great attention, however, has been paid in that country, since the era of Mahomet, to the possession of a light, agile and enduring frame, intelligence and tractability of character, and the perpetuation of these qualities, by the most scrupulous regard for the purity of blood. This is equally true of the Barb, or pure-bred horse of Morocco, and those of the northern coast of Africa, in Egypt, among the Turks, and indeed wherever the followers of the Prophet are to be found. It is unquestionable that the influence of the Eastern blood among the choicest animals of modern Europe has been followed by great improvements in racing stock. Yet it is equally certain that the race horse, both of England and the United States, has accomplished what has never been demonstrated as within the ability of their progenitors; and on repeated trials with the Eastern horses, he has shown himself confessedly their superior in speed, strength and endurance.

The experience of Eastern blood in this country, in comparison with the best English, is decidedly in favor of the latter. We have had one horse of unsurpassed excellence, which a fortunate accident threw upon our shores a short time previous to 1770. This was the white Barb, *Ranger*, which was presented by the Emperor of Morocco, as the choice of his stud, to an English naval officer, for some distinguished service. On his route homeward, the animal was set on shore for exercise at an intermediate port, where, in his gambols, he broke three of his legs, and, thinking him worthless, his owner gave him to the commander of a New England merchantman, then present. He was readily accepted, and placed in slings on board of his vessel, and recovered. This animal stood for many years in the eastern part of Connecticut, and on their good mares produced a numerous progeny of unrivalled cavalry horses, which rendered invaluable service in the troop commanded by that consummate partisan, Captain (afterwards General) Lee, of the revolution. It is said the favorite white field-horse of General Washington was of the same stock. He was afterwards sold to Captain Lindsey,

as a special favor, and taken to Virginia, where he produced some good racers. Bussorah, a small sorrel horse, brought into this country from the head of the Persian Gulf, in 1819, then five years old, got many choice roadsters, though few if any racers. The Narraganset pacers, a race belonging to our Eastern States, but for many years almost extinct, possessed for a long time an unrivalled reputation for spirit, endurance, and easy, rapid motion under the saddle; and they are said to have originated from a Spanish horse, many of which are pure descendants of the Barb. As an offset to these isolated examples of success in this country, we have numerous instances of the importation of the best Orientals, which have been extensively used on some of our superior mares, without any marked effect. We shall refer to three prominent importations only. The first consisted of two choice Arabians, or Barbs, selected in Tunis by General Eaton, and sent to his estate in Massachusetts. The second was a present of four choice Barbs from the Emperor of Morocco to our government, in 1830; and the third consisted of two Arabians, sent by the Imaum of Muscat, near the Persian Gulf, to our government, in 1839 or '40. These were all claimed to be, and no doubt were, of the pure Kochlani, the unadulterated line royal; yet none have earned any distinguished reputation. Some years ago, about 1857 or '8, two choice Arabian horses were sent from Africa, a present to Gov. Seward, of New York. They were bred to many mares in different parts of that State, during four or five successive years, and some good colts got by them, but they failed to get anything of distinguished value—not at all equal to many of the American-bred horses.

It is to England we are mainly indebted for the great improvement in our blood, road and farm horses. A numerous race of fine horses were reared on that Island, long previous to any authentic history of it; for in his first invasion, Julius Cæsar took many of them to Rome, where they immediately became great favorites, although this mistress of half the known world had already plundered every region of some of their best breeds.

What might have been the particular merit of the English horse at the time of the Norman invasion, is not known, but it is certain that the Saxon cavalry under Harold, were speedily overpowered by William, at the battle of Hastings, which at once secured the throne to the Conqueror. History first informs us of the improvement of British horses, by importations from abroad during this reign, which consisted of a number of Spanish stallions. These were supposed to be strongly imbued with the Arabian or African blood, which had been brought over to that country by the Moors, who had founded the Saracenic empire in the Peninsula, three centuries before. More than a century later, King John made some importations from Flanders, to give weight and substance to their draught and cavalry horses. The improvement of their various breeds, was afterwards pursued with more or less judgment and zeal, by other British monarchs, till they reached their highest excellence during the middle of the last century. Flying Childers, Eclipse, Highflyer, and others on the course, have probably exceeded in speed anything ever before accomplished; while the draught horse, the roadster, the hackney, the cavalry horse and the hunter, attained a merit at that time, which some good authorities claim, has not been since increased. It is even asserted, that some of the more serviceable breeds have been seriously injured by too great an infusion of the blood; while the almost universal absence of long heats on the turf, has tended to the improvement of speed rather than bottom in the race horse.

The improvement of the horse in this country, has not been a matter of record or history, till within a comparatively recent period. But it has silently, and with no little rapidity been going forward, for more than a century, till we have attained a race of animals, throughout the Eastern and Middle States at least, which probably equal those of any other country for adaptedness to draught, the road and the saddle. This improvement has been mainly brought about, by the importation of some of the *best and stoutest of the English blood.* In breeding from these for pur-

poses of utility, particular reference has been paid to strength, endurance and speed. No horses surpass our best four mile pacers; none equal our trotters. The world has not seen their equal. It was not many years ago that a mile in three minutes was thought a prodigious speed for a horse; but in the year 1867, Dexter trotted his mile in two minutes seventeen seconds, and it is contended that he can even do better than that surprising feat. Though much inequality exists in those bred for our various other uses, yet for profitable service, it is believed, no equal number of animals elsewhere, can excel those in the region above indicated. It would be a superfluous task to attempt enumerating all the imported horses that have contributed to this improvement. Each good animal has done something. But among the earlier horses which may be named with distinction, as having effected much for our useful beasts, are Lath, Wildair, Slender, Sourkrout, Tally-ho, Figure, Bay Richmond, Expedition, Baronet, and a host of others. Pre-eminent among these, was imported Messenger. He was foaled in 1780, imported in 1788, and died in 1808. He stood in different places in New Jersey; and in Duchess, Westchester and Queens counties in New York; and upon the mares derived from the foregoing and other good horses, he got a numerous progeny of illustrious descendants. Of these, we may name those capital stallions, Potomac, Hamiltonian, Bay Figure, Engineer, Mambrino, Tippoo Saib, Columbus, Gunn's, and Bushe's Messenger, and many others, which were extensively disseminated over the Northern and Middle States; and he has the credit of imparting a large share of his merits to his grandson, that nonpareil of horses, American Eclipse, and through Eclipse to his later posterity of the present day. His descendants were so numerous and widely spread, that it may be safely asserted, that of the best horses bred in the above States, scarcely one can now be found which does not trace one or more crosses to his distinguished sire. His success in producing roadsters, besides his blood qualities of speed and endurance, consisted in his great strength and the peculiar formation of his limbs, large

forehand and deep quarters, in which he excelled any other of the imported bloods. Later horses, as Lexington, Kentucky, (reared in Kentucky,) and others of recent years, have kept the high reputation of their sires. The United States has now, probably, as good blood horses as the world can show.

As an illustration of what may be accomplished by judicious breeding with the present materials in our hands, we mention one family of the American roadster, which is strongly tinctured with blood, and which has attained an enviable notoriety among the choicest of the Northern horses. They are derived from the *Morgan horse* of Vermont, that was foaled in Springfield, Mass., in 1793. He was got by True Briton, (supposed to have been bred by Gen. Delancey of New York, and got by imported Wildair,) or one of his sons, a horse of such distinguished excellence, as to have been re-exported to England for the benefit of his stock. The Morgan horse stood in Vermont from 1795 till his death, at an advanced age. From him and the choice mares of Vermont, descended many excellent colts; and his merits were inherited in an eminent degree by three of his sons, which stood in the same state and continued the career of improvement commenced by the sire. The result was the production of a family of roadsters, of much similarity of appearance* and uniformity of character, unsurpassed by any others of their size for serviceable qualities. They were of medium size, from thirteen and a half to fifteen hands high; with a well-formed head and neck; high withers; deep chest; round body; short back; long quarters; broad flat legs; moderately small feet; long wavy mane and tail; presenting altogether the beau ideal of the road horse. They are spirited, docile, hardy, and easily kept. They have an easy, rapid trot, and glide along with a good load, without clatter or apparent effort, at the rate of ten or twelve miles an hour. This family of horses—for they are *not* a *breed*, being chiefly of

*Many of the Morgan horses have shown the steep rump and heavy breast and neck, which indicates a Norman cross on the side of their dams, which has been largely imported through the French horse in the adjoining Canadian settlements; but none of these points are said to have characterised the founder of the race.

local rearing in the hilly regions of northern New England—gained considerable celebrity for a time; yet they ceased to be "Morgans" when taken to the milder climates and richer soils west and south of Vermont, as they gained larger size on the heavier pastures and more stimulating food of the richer lands. With all their fine qualities of look and action, they proved too small for the main purposes demanded of a thorough-going business horse, and have measurably gone out of fashion. They are mentioned, merely as a type of what the serviceable roadster ought to be, and what he may become by the use of the proper instrument for breeding. And if the materials already in our hands are intelligently and perseveringly used, we can produce all we require of horseflesh.

Besides our unsurpassed blood horses, we have others derived from various sources, and especially from the different English breeds, all of which are variously compounded, with the first and with each other. On our north-eastern frontier, the *Canadian* prevails, a bastard but not degenerate race, made up of the French Norman and the English or American. At the extreme south and west, we have the *horse of Spanish origin*, obtained in his domestic state in Florida and Louisiana; and from another branch of the Spanish, are descended the wild horses of Mexico and the more northern prairies. These are diversified in character, and generally possess medium size and merit. The *Conestoga*, a heavy roadster, and draught horse of fine symmetry, and great power, is principally reared in Pennsylvania, and is used for the team and truck. He is an amalgamation of several breeds, but probably owes a share of his character to the Flemish horse, for which there was a decided partiality among the numerous German emigrants of that State. Several varieties of *ponies* are to be found in different sections, but principally among the French, the half-breed, and the Indians upon the frontiers, who have bred a stunted race from the Canadian or wild horse, and such others as could survive the hard usage and scanty winter food, afforded by nature and their rude husbandry. Many of these have con-

siderable beauty and symmetry, and are fleet, hardy and spirited. The *modern Norman*, or mixture of the old French Norman draught horse, (heavy framed, big limbed, but stout and hardy,) and the Andalusian, a descendant of the Moorish Barbs, has been introduced within a few years, and will unquestionably become approved as a useful and serviceable animal for many purposes. He exhibits the qualities of both ancestry in the proper proportions for farm service. He has a thick head; lively, prick ears; short, heavy neck; large breast and shoulder; strong limbs; well knit back; large quarters, with much wavy mane, tail and fetlock. Like his French progenitor, he frequently stands low in the withers, which enables him to throw great weight into the collar; and the diminished, flattened leg, the wind and game derived from his Moorish blood, give him much of the capacity and endurance of the thorough-bred. The *Percheron*, another variety of the French draught horse, has also been lately imported, and may prove valuable in imparting additional good qualities to our heavier style of horses. The *English cart horse*, of which the *Suffolk Punch* is the finest specimen we have seen, and the *Clydesdale*, from Scotland, brought into Upper Canada, have made up some of the best heavy dray horses in the country, and late importations have refreshed the breed with additional choice specimens. The *Cleveland bay*, a large and heavy coach horse, has been introduced of late, but not bred to any extent of superior excellence. The *Norfolk trotter*, *Belfounder*, was imported many years ago, and with our high-bred mares, he produced many choice roadsters and trotters.

The remainder of our horse-flesh deserving of any notice is chiefly composed of such as are superior in point of blood and merit. The improvement in the American horse is conspicuous and decided. Judicious breeders have obtained qualities in the descendants which they sought for in their imported sires, and the infusion of some of the stoutest of the blood is rapidly gaining an ascendancy in the general stock; and we are confident our intelligent agriculturists will not permit this to proceed to an

extent that may be prejudicial to their value as draught horses, as has been done in some portions of England and our Southern States. There is no danger from excess of blood, if it be of the right kind; but it is seldom found combining that fullness and stoutness, and that docility and tractableness of disposition which are essential to the gig horse or the horse of all work. Youatt says truly, that "the road horse may possess different degrees of blood, according to the nature of the country and the work required of him; (he might have added with propriety, *and according to the character of the blood.*) His legs will be too slender; his feet too small; his stride too long, and he will rarely be able to trot. Three parts or half, (of the thorough-bred,) and for the horse of all work, even less than that will make a good and useful animal." For the saddle only, the high-bred is never objectionable to an enterprising and accomplished rider, if not disposed to be vicious. His long, elastic pasterns give easy, flexible motions; his quick and almost electrical obedience when under thorough discipline; his habitual canter and high spirit always commend him for this purpose.

Some of the prominent external points of a fine saddle or buggy horse are, a moderately small head, free from fleshiness; fine muzzle and expansive nostrils; broad at the throat and wide between the eyes, which denotes intelligence and courage; a dished face indicates high breeding, and sometimes viciousness; a convex or Roman nose frequently betokens the reverse; the ears rather long, yet so finely formed as to appear small, and playing quickly like those of a deer; and the eyes clear, full and confident, with a steady forward look. Glancing them backward or askance with a sinister expression, and with none or only a slight movement of the head, is indicative of a mischievous temper. The neck should be handsomely arched, and fine at the junction with the head, while the lower extremity must be full and muscular, and well expanded at the breast and shoulders. The latter ought to be high and run well back; the withers strong, firmly knit and smooth; the breast even in front, of medium width, and supported

by a pair of straight fore-legs, standing well apart. The chest should be deep and the girth large; the body full, and not drawn up too much in the flank; the back short, and the hips gathered well towards the withers; the loins wide and rising above the spine; the ribs springing nearly at right angles from the back, giving roundness to the body. The hips ought to be long to the root of the tail, and the latter may approach to near the line of the back, which is a mark of good breeding. Both the thigh and hock should be large and muscular; and between the hock, or knee, and pastern, the legs should be broad, flat and short; the hind legs properly bent, and all well placed under the body; the pasterns of moderate length, and standing slightly oblique; the hoof hard, smooth, round before, and wide at the heel; the frog large and sound; and the sole firm and concave. A white hoof is generally tender, easy to fracture and to lame, and difficult to hold a shoe.

The draught horse ought to differ from the foregoing, in showing greater compactness, a heavier and shorter neck, a wider and stouter breast, and lower withers, so as to throw the utmost weight into the collar; a heavier body and quarters, larger legs and feet, and more upright shoulders and pasterns; yet he should be full and round in the body, and carry a face of docility and intelligent expression.

Considerations which affect the Value of the Horse.—The color is not material, provided it be not pied or mealy. No better color for horses can be found than the dark bay or brown, with black mane, tail and legs. Chestnut is also an admirable color. But most of the other colors are frequently found with the best horses. Hard-mouthed horses, when accompanied with great spirits, are objectionable, as they require peculiar bitting and the utmost vigilance. The paces and action of a horse are important, for if good, they give a much greater capacity for performance. Some of these depend on form and structure, and are unchangeable; others are the result of breaking. All horses should be taught to walk fast, as it is their easiest and most economical

pace, and it will help them over a great deal of ground in a day, even with a heavy load, and with comparatively little effort. A horse that steps short and digs his toes into the ground, is worthless as a traveler, and suited only to a ferry boat or bark mill. It is important that a horse be good tempered. If inclined to viciousness, he should be gently yet firmly managed when it is first apparent. A resort to great severity will be justified, if necessary to conquer him; for if once allowed to become a habit, it will be difficult to cure him. Grooms and mischievous stable boys frequently do much injury by their idle tricks with horses, and when detected, they should be discharged at once. Some horses are nervous, easily excited, and start at every unusual noise or object. Others are restive and fretful, and ever anxious to be on the move. Kindness, and firm, yet mild treatment, by which their motions and will are at all times controlled, and their confidence secured, are the only remedies. Others are inclined to sluggishness. These should have stimulating food, and never be overloaded or overworked, and then kept well to their paces. Whatever they are capable of performing, can in this way only be got from them. Habit has great influence with animals, as with man; and when within the compass of his ability, he may be habituated to any reasonable physical exertion. More horses are ruined by unskillful breaking and overwork when under six years old, than in any other way. A horse ought never to be put to full work before seven years old.

Breeding.—Agreeably to the general principles before enumerated, such animals should be selected as most eminently possess those points which it is desired to propagate, and these they should not only exhibit in themselves, but should inherit as far as possible from a long line of ancestry. For the perpetuation of particular points in progeny, it would be safer to rely on the latter quality than the former. The selection of a mare, relatively larger than the horse, is an important rule in breeding, and it is believed that much of the success of Arabian and other Eastern horses as stock-getters, has resulted from the application

of this principle. They possess valuable traits, but condensed within too small a compass. When such an animal is put to a well-bred, larger mare, the fœtus has abundance of room and nourishment to develop and perfect the circumscribed outlines of the male parent, and acquire for itself increased volume and character. The horse ought not to be less than four or five, and the mare one year older before being put to breeding. It would be still better to defer it for two or three years, or till the frame is fully matured. A mare intended for breeding should never be highly fed on grain, nor overworked; or if they have been so, a previous run of some months on grass, or hay without grain, should be allowed to put them into natural condition.

The gestation of the mare sometimes varies from forty-four to fifty-six weeks, but she usually goes with young from forty-seven to fifty; and it is advisable she should take the horse at a time which will ensure the foaling when the weather is settled, and there is a fresh growth of grass. She will be the better for light working till near the time of foaling, if well, but not too abundantly fed. In a few days after this, she may resume moderate labor; and if not in the way or troublesome, the foal may run with her; but if she is exposed to heating, it should be confined till she cools, as suckling then is decidedly injurious to it. The mare is in danger of slinking her foal from blows and over exertion, the use of smutty grain, foul hay, or offensive objects of smell; and when this has once occurred, which happens usually in the fourth or fifth month, she should afterwards be generously fed at that period, and only moderately worked. When liable to slinking, the mare should be removed from others in foal, lest a peculiar sympathy should excite an epidemic. The mare comes in heat from nine to eleven days after foaling, when she should be put to the horse, if it be desirable to have a colt the following season. She comes round at intervals of about nine days each.

Management of the Colt.—The colt may be weaned when five to seven months old, and preparatory to this, while with the mare, may be taught to feed on fine hay, meal or oats. When

taken away, he should be confined beyond a hearing distance of the dam, and plentifully supplied with rowen or aftermath hay, mashed or ground oats, or wheat shorts. It is economy to provide a warm shelter through the inclement season for all animals, and especially for colts, which with all other young, should have an abundance of nutritious food. They will thus grow evenly and rapidly, and attain a size and stamina at two years old, they would not otherwise have acquired at three. Every colt should be thoroughly halter broken during the winter before a year old. He will be all the easier managed afterwards.

Castrating.—The colt should be altered at about one or one and a half years old, but if thin in the neck and light before, the operation may be deferred to a year later. Few of the French diligence and farm horses, and scarcely any of the Oriental, are ever castrated. They are thought to be more hardy and enduring; but the slight advantage they may possibly possess in this respect, would illy compensate for the trouble and inconvenience arising from their management. The operation should be performed late in the spring or early in autumn, while the weather is mild. If in high condition, the animal should be well physicked. The easiest, safest and most convenient way is to cast him by ropes on his legs. The scrotum should be opened on both sides and the testicles cut, or rather the cord scraped off, and tied, which prevents much bleeding. The wound may be dressed with a little lard; then turn him loose in a pasture which has a shelter from sun, wind or rain. *Docking* is practiced by many, but merely to gratify an absurd and cruel caprice, without a single advantage, and the animal is better in every respect with the tail unmutilated. *Nicking* is an inhuman custom, and now unfashionable. We omit any description of it. It has been in and out of fashion for several years together since our recollection.

BREAKING.—While feeding in the stable, the colt should be gently treated, and accustomed to the halter and bit, which prepares him for breaking. If permitted to run with the others while at work, he becomes familiarized to it, and when harnessed

by the side of some of his well trained mates, he considers his discipline rather a privilege than a task. The colt may be taken in hand for breaking at three, and thoroughly broken to light work at four, but should not be put to hard service till six or seven. A due regard to humanity and sound judgment, in thus limiting the burthen in his early years, will save much disease and suffering to the animal, and profit the owner by his unimpaired strength and prolonged life. The annual loss from neglecting this precaution is enormous, which might be entirely avoided, by less eagerness to grasp the substance, while as yet the shadow only is within reach. Many animals are thus broken down at twelve, and are in their dotage at fifteen, while others of good constitution, if well treated, perform hard service till thirty.

Longevity of the Horse.—Mr. Percival mentions one that died at sixty-two. Mr. Mauran, of New York, had a fine gig and saddle horse, which was, in his forty-fifth year, sound, spirited and playful as a kitten. He was of a dark brown with a tanned nose. We never saw a horse with a buff or bear muzzle, that had not great endurance. American Eclipse successfully covered mares in Kentucky at the age of thirty-one, the result of late and light service till his sinews became fully matured. We knew a large, compact, flea-bitten horse, thirty years old, at work, dragging a heavy load in a single cart, which was formerly used as a coach horse, and apparently sound and vigorous. The writer worked a noble family carriage horse, of his own breeding, from five until twenty-eight years old; and a better, truer, honester, more spirited, docile, intelligent animal, never looked through a bridle. His death bereft us of an old and dear friend.

Feeding.—The vigor and duration of the horse depend much on proper feeding. Like the cow and sheep, his natural and proper aliment is the grasses, grain and roots. In the middle and northern sections of the country, his dry forage is almost invariably good meadow hay, generally timothy, which is the richest of the cultivated grasses. At the South, this is often supplied by the blades of Indian corn. But in all the States, a great

variety of the grasses and clover are used. When put to hard labor, grain ought always to accompany hay in some form. Of the different kinds of grain, oats are peculiarly the horse's food, and they are always safe, digestible and nutritive. Barley is the best substitute for it. Wheat and Indian corn are sometimes given, but either, alone, are unsuitable; the first is too concentrated, and the last too heating. They ought to be sparingly used, and only when ground. The offal of wheat, as shorts, or bran, is excellent, particularly when mixed with about one-third Indian corn meal. Grain is always more advantageously fed when ground or crushed, and wet some time previous to eating; and it is still better when cooked. On both sides of the Mediterranean, in the Barbary States, in Spain, France and Italy, much of the food is given in small baked cakes, and the saving in this way is much greater than the expense of preparing it. When confined to dry food, roots or apples fed once a day, are always beneficial. They keep the bowels open, the appetite and general health good, and contribute largely to the nutriment of the animal. Carrots are the best of the roots, as besides giving muscle and working power, they more than any other, improve the wind and remove all tendency to heaves. They have even been found effectual in curing an obstinate cough. By many of the keepers of livery stables, they are always used, for which purpose they command the same price as oats. Potatoes, parsnips, beets and Swedes turnips, in the order mentioned, are next to be preferred. Potatoes are improved by cooking. Mixtures of food are best, as of cut hay, meal and roots. Old horses, or such as are put to hard labor, will do much better if their food be given in the form easiest of digestion. No inconsiderable part of the vital power is exhausted by the digestion of dry, raw food. Horses ought to be fed, and if possible, exercised or worked regularly, but never on a full stomach. This is a frequent cause of disease, and especially of broken wind. If their food is given at the proper time, and the horse be allowed to finish it at once, without expecting more, he will lie down

quietly and digest it. This will be much more refreshing to him, than to stand at the rack or trough, nibbling continually at his hay or oats. What remains after he has done feeding, should be at once withdrawn. They should have water in summer three times, and in winter twice a day. Soft or running water is much the best. While working, and they are not too warm, they may have it as often as they desire. Neither should they be fed when heated, as the stomach is then fatigued and slightly inflamed, and is not prepared for digestion till the animal is again cool. Salt should always be within reach, and we have found an occasional handful of clean wood ashes, a preventive of disease and an assistance to the bowels and appetite.

CHAPTER XIX.

THE ASS, THE MULE, AND THE COMPARATIVE LABOR OF WORKING ANIMALS

THE ASS

Is a native of Arabia, Persia, and the central parts of Asia and Africa. Like the horse, he goes in troops, and displays great natural sagacity, activity and courage. Job says, "he scorneth the multitude of the city, neither regardeth the crying of the driver." Like the horse, too, he has from time immemorial been tamed, and become the faithful servant of man; but, unlike him, he is subject to few maladies, is hardy and enduring, and subsists, and even thrives, on coarse and scanty forage. Thus Job says of his natural haunts: "Whose house I have made the *wilderness*, and the *barren land* his dwellings; the range of the *mountains* is his pasture, and he searcheth after *every green thing*." And Xenophon, in his Anabasis, a thousand years later, says of one of the Asiatic deserts through which he passed with the army of Cyrus, "that it was full of wormwood; if any other kinds of shrubs or reeds grew there, they had all an aromatic smell, but no trees appeared. Of wild creatures, the most numerous are *wild asses*, which our horses sometimes chased, but the wild asses exceeded them much in speed."

VARIETIES.—The different breeds of asses are supposed to be quite as numerous as those of the horse. Four distinct races are mentioned in the ancient scriptures. In modern times we find a similar diversity. There are two kinds in Persia; the largest a slow, heavy brute, used only for burdens; the other smaller and

more spirited, and used for the saddle. In Egypt, a considerable though less marked difference exists, those near the Delta being inferior to those which are bred in upper Egypt and Nubia. In Spain, a difference in size and spirit prevails, greater even than in Persia. The *Zebra* is nearly allied in size, shape and character to the wild ass, but his untamable ferocity has hitherto effectually bid defiance alike to the scourges and caresses, the frowns and the favors of man. Arabia produces some of the most spirited and hardy asses, but their size, like that of their horses, is too small for purposes of the greatest utility. The Maltese jack is, by American breeders, deemed the choicest animal from which to propagate. He is evidently of Arabian descent, and posesses all the good qualities of his ancestry, with considerable additional size. We have several varieties, all of which are imported, as there are no natives of the Western Continent. The early importations were principally made from the Azores and Cape de Verd Islands, and were mostly of an inferior character. A superior Maltese jack was presented to General Washington, in 1787, by La Fayette, and is believed to be the first ever sent to this country. Mr. Custis describes him as of moderate size, clean limbed, possessing great activity, the fire and ferocity of a tiger, of a dark brown and nearly black, white belly and muzzle, and manageable only by one groom, nor then safely. He lived to a great age. His mules were all active, spirited and serviceable, and when from stout mares, attained considerable size. A Spanish jack and jennet were also presented to Washington about the same time, by the King of Spain. The first is characterized by the same authority as a huge, ill-shapen animal, nearly sixteen hands high, very large head, clumsy limbs, and to all appearance little calculated for active service; he was of a gray color, and not much valued for his mules, which were unwieldy and dull. From the Maltese jack and Spanish jennet, which approach the size of the large Spanish jack, was bred a valuable animal, (*Compound*,) which partook of all the good qualities of the sire, with the weight of the dam. From him descended many

of the best mules of Mount Vernon. Many other valuable importations have since followed these early animals, and it is believed we have for many years had as fine specimens of the ass as the world affords. Jennets, or she asses, are used among us principally for breeding jacks, and of course are not numerous. They are sometimes, though seldom, bred to the horse. It is difficult to induce the horse to notice them, and the produce, which is called a hinny, is less hardy and useful than the mule. The milk of the she ass is lighter and more digestible than that of any other animal, and in former times was in great request for invalids.

In this country, the ass is occasionally used in the cart, or as a beast of burden. Such as are employed for these purposes are generally of an inferior kind, and are only used for the lightest work. They may sometimes be seen among the fish-mongers and small vegetable dealers about our city markets, but little larger than a Shetland pony, trundling along a light cart with a wheelbarrow load. In ancient times, they have been, and in foreign countries at the present time, they are extensively used by the peasantry and cottagers, to whom they prove a cheap and convenient drudge in the many miscellaneous labors of their various employments.

There is probably no living animal that so well answers so many purposes for drudgery in the humbler employments of the poor as the cheap *donkeys* of Europe, in the British Islands, and on the Continent. They are of diminutive size, ranging from three and a half to four feet high, yet possessing all the assinine qualities, except high breeding and the larger size of those more exclusively used for mule propagation. They are kept by all classes of the lower laborers, cottagers, tinkers, peddlers, strolling handicraftsmen—in fact every class of the small, self-supporting classes. They breed freely, live in the cheapest possible way, under shelter, or without it; on the roughest forage by the road-side, or in pastures, or on cured forage in the stables. They are docile, ever ready for the harness in cart or wagon, or the pan-

niers; will carry burdens and draw loads almost incredible for their size and weight; are good and handy for nudging about under the saddle, with a stout rider upon it; a companion and drudge for the children and servants—in short, a most serviceable, indispensable little brute for various uses, when horse or even mule labor for like purposes would be both costly and inconvenient. There is, in fact, no such useful animal so much maligned as the donkey—otherwise, "jackass"—and none which we, Americans, should sooner introduce into many of the humbler employments which now abound and are rapidly multiplying in our more densely populated districts. "Stupid as a jackass!" It is a vile slander; not half so stupid are they as many owners who brutally maltreat them and get a living out of their labors, wanting which, they would starve.

THE MULE

Is the hybrid produced by the ass with the mare. How early this animal was bred is uncertain, but we know he was in high repute in the reign of David, near three thousand years ago, for he was rode by Absalom, the favorite prince of Israel, on the field of battle. They have from time immemorial been bred in various parts of the East, on the borders of the Mediterranean, and throughout Spain, Portugal and other countries, many of them being of splendid appearance and of fine qualities. In these countries, they are frequently used by the grandees and nobles, and indeed by royalty itself; and however much they may be undervalued elsewhere, when they are finely bred and trained, and richly caparisoned, they exhibit a stateliness and bearing that few of the highest bred horses can excel.

Breeding Mules in the United States, was commenced with much spirit in some of the New England States, soon after the American revolution. The object was not to breed them for their own use, but simply as an article of commerce. They were at first shipped exclusively to the West Indies, and afterwards to the South and West, for employment in the sugar mills, and

other work on the plantations. Indifferent animals, both as sires and dams, were used at first, as anything which bore the name of mule, then commanded a ready sale. These were necessarily inferior brutes, and viewed with almost universal derision in the States where they were bred; and being considered the type of their race, a prejudice was excited against them, which more than half a century has not been sufficient to dispel. Among a few thinking men at the North, they have been adopted and made highly useful in the various duties of the farm. Of late they have been largely introduced into the Middle States, where they perform many useful slow labors in draught equally well as in the planting States. It is in the South, and in other and hotter climates, that the superior merits of the mule over the horse as a laboring animal, are peculiarly manifest. In many instances they are indifferently fed, hardly worked, and greatly neglected by their drivers, and yet they sustain themselves for years in defiance of usage that would annihilate two generations of horses. Their powers have been largely increased and their merits improved, by the introduction of some of the best Maltese and Spanish jacks, and the use of large, blood mares. The propriety of this course is seen in the value of the product; for while some of the inferior brutes are unsalable at $50, others of the same age, and reared under the same circumstances of keep and condition, could not be purchased for $150 to $300 each.

The breeding, rearing and management of mules is similar to that of colts. They will be found, as much as horses, to repay generous keep and attention by their increased and rapid growth. But they should not be pampered by high feed, as it not only has a tendency to produce disease, but to form habits of fastidiousness, which materially lessens their economical feeding in after life. The diseases to which mules are subjected which are always few,—and if properly managed they will seldom or ever occur,—require a treatment like that of horses. Mules, as a rule, are unable to breed, although instances of their producing young have sometimes occurred; but we have never learned of any of

their offspring living to adult age. Neither the sexual development or propensities are wanting, but they are seldom indulged with effect. Mr. Kilby, of Virginia, stated in the "Farmer's Register," that a mare mule brought two colts, got by a young horse, which they closely resembled. The first was a male, and died, apparently with staggers, which no treatment could arrest, at six months old. The second was a female, from the same parents, sixteen months younger than the first, marked like the sire, being jet black, excepting a white foot, and star in the forehead, and died at a year old, after a two days' illness, notwithstanding the utmost care was bestowed upon it. Successful propagation of this hybrid, however, beyond the first cross, seems to be incompatible with the fixed laws of nature.

With a view of encouraging the substitution of mules for a part of the horses now employed in American husbandry, we give the following testimony from experienced individuals of great intelligence and careful observation:

Advantages of Mule over Horse Labor.—The official report of an agricultural committee in South Carolina, in 1824, says: "The annual expense of keeping a horse is equal to his value; that a horse at four years old would not often bring more than his cost; that two mules could be raised at less expense than one horse; is fit for service earlier, and if of sufficient size, will perform as much labor; and if attended to when first put to work, his gait and habits may be formed to suit the owner." Mr. Pomeroy, who used them near Boston for thirty years, and to such an extent as to have had more labor performed by them probably than any person in New England, says: "I am convinced the small breed of mules will consume less in proportion to the labor they are capable of performing than the larger race, but I shall confine myself to the latter in my comparison, such as stand fourteen and a half to sixteen hands, and are capable of performing any work a horse is usually put to. From repeated experiments I have found that three mules of this description, which were constantly at work, consumed about the same quantity of hay,

and only *one-fourth* the provender which was given to two middling size coach horses, only moderately worked. I am satisfied a large sized mule will not consume more than three-fifths to two-thirds the food to keep him in good order, that will be necessary for a horse performing the same labor. The expense of shoeing a mule the year round, does not exceed one-third that of the horse, his hoofs being harder, more horny, and so slow in their growth, that shoes require no removal, and hold on till worn out; and the wear from the lightness of the animal is much less. Mules have been lost by feeding on *cut* straw, and corn *meal;* in no other instance have I known disease in them, except by inflammation of the intestines, caused by the grossest exposure to cold and wet, and excessive drinking cold water, after severe labor, and while in a high state of perspiration. It is not improbable a farmer may work the same team of mules for twenty years without having a farrier's bill presented to him. In my experience of thirty years, I have never found but one mule inclined to be vicious, and he might have been easily subdued while young. I have always found them truer pullers and quicker travelers, with a load, than horses. Their vision and hearing are much more accurate. I have used them in my family carriage, in a gig, and under the saddle; and have never known one to start or run from any object or noise, a fault in the horse that continually causes the maiming and death of numerous human beings. The mule is more steady in his draught and less likely to waste his strength than the horse, hence more suitable to work with oxen, and as he walks faster, will habituate them to a faster gait. In plowing among crops, his feet being small and following each other so much more in a line, he seldom treads down the ridges or crops. The facility of instructing him to obey *implicitly* the voice of the driver is astonishing. The best plowing of tillage land I ever saw, I have had performed by two mules *tandem*, without lines or driver. The mule is capable of enduring labor in a temperature of heat that would be destructive to a horse. Although a large mule will consume something over one-half

the food of the horse, yet the saving in shoeing, farriery, and insurance against diseases and accidents, will amount to at least *one-half.* In addition, the owner may rely with tolerable certainty on the continuance of his mule capital for thirty years; whereas the horse owner must, at the end of fifteen years, look to his crops, his acres, or a bank, for the renewal of his. The longevity of a mule is proverbial. Pliny mentions one eighty years old; and Dr. Rees, two in England, that reached the age of seventy. I saw one performing his labor in a cane mill in the West Indies, which the owner assured me was forty years old. I have a mare mule twenty-five years old, that I have had in constant work for twenty-one years. She has often within a year, taken a ton weight in a wagon to Boston, five miles, and manifests no diminution of her powers. A neighbor has one twenty-eight years old, which he would not exchange for any horse in the country. One in Maryland, thirty-five years old, is now as capable of labor as at any former period."

Mr. Hood, of Maryland, in the "American Farmer," estimates the annual expense of a horse for twelve months at $44, and that of a mule at $22, just half price, and his working age at more than twice that of the horse, and that, too, after thirty years' experience in keeping both. A correspondent of the "Baltimore Patriot" asserts that "Colonel John E. Howard had a pair of mules that worked thirty years, after which they were sold to a carter in the city, and performed hard service for several years longer. Many mules twenty-five years old, and now in this county, perform well. Many have been at hard work for twelve or fifteen years, and would now sell for $100 each. They are not subject to the colt's ailments, the glanders, heaves, yellow-water, and colic, like horses, and seldom are afflicted with spavin, ring-bones, or bots; and they will not founder." General Shelby says "he has known mules to travel ten miles within the hour in light harness, and has himself driven a pair forty miles in six hours, stopping an hour by the way." Major Shelby, of Lexington, sold to Mr. Preston four match mules, for $1,000. They

were, of course, very superior animals, and made elegant coach horses. Mr. Preston has driven these mules eighty miles in a single day, without injury, and they proved a first rate team for many years. Mr. Ellicott, of the Patuxent Furnaces, says: "Out of about one hundred mules at the works, we have not lost, on an average, one in two years. Bleeding at the mouth will cure them of nearly every disease, and by being turned out on pasture, they will recover from almost every accident. I do not recollect we have ever had a wind-broken one. They are scarcely ever defective in the hoof, and though kept shod, it is not as important as with the horse. Their skin is tougher than that of a horse, consequently, they are not as much worried by flies, nor do they suffer so much with the heat of summer."

To the foregoing testimony may be added that of the late Judge Hinckley, of Northampton, Massachusetts, a shrewd and close observer through a long life, reaching to eighty-four years. He bred mules at an early day, and always kept a team of them for his farm work, much preferring them to horses for this purpose, after an experience of fifty years. He had a pair nearly thirty years old, which, in light pasturage in summer, and with a moderate supply of hay and very little grain in winter, and no grooming, performed all the drudgery, though he kept his stable full of horses besides. They outlived several successive generations of horses, and though the latter were often sick and out of condition, the mules never were. One from his stock, forty-five years old, was sold for the same price paid for a lot of young mules, he being at that mature age, perfectly able to perform his full share of labor.

For the caravans, which in past years have drawn their loads over the almost inaccessible ranges which form the continuation of the Rocky Mountains, and the extensive arid plains that lie between and west of them, on the route from Santa Fe to California, mules have been the only beasts of burden used in these exhausting and perilous adventures. Their value may be estimated from the comparative prices of mules and horses; for while

a horse may have been bought for $10 to $20, a good mule was worth $50 to $75. Dr. Lyman, who passed through those regions twenty years ago, informed us that their caravan left Santa Fe with about one hundred and fifty mules, fifteen or twenty horses, all beasts of burden, and two choice blood horses, belonging to an English gentleman, which were led and treated with peculiar care. On the route, all the working horses died from exhaustion and suffering; the two bloods that had been so carefully attended, but just survived; yet of the whole lot of mules, but eight or ten gave out. A mule thirty-six years of age, was as hardy, strong, enduring, and performed as hard labor, as any one in the caravan. When thirst compelled them to resort for successive days to the saline waters, which are the only ones furnished by those dry and sterile plains, the horses were at once severely, and not unfrequently, fatally affected, while the mules, though suffering greatly from the change, yet seldom were so much injured as to require any remission of their labor.

The mules sent to the Mexican possessions from our Western States, Arkansas, Missouri, Tennessee, and Kentucky, are considered of much more value than such as are bred from the native (usually wild) mares. The difference probably arises, in part, from the Mexicans using jacks inferior to those so highly improved of late years by our western citizens. Mare mules are estimated in those regions at one-third more than horse mules. The reason assigned for this is, that after a day's journey of excessive fatigue, there is a larger quantity of blood secreted in the bladder, which the female, owing to her larger passage, voids at once and without much apparent suffering, while the male does not get rid of it, frequently, till after an hour of considerable pain. The effect of this difference is seen in the loss of flesh and strength in the male, to an extent far beyond that of the female. Tho universal method of reducing refractory mules in the northern Mexican possessions, is for the person to grasp them firmly by the ears, while another whips them severely on the forelegs and belly.

Estimated annual saving to the United States from the employment of Mules in the place of Horses.—To sum up the advantages of working mules over horses, we shall have as advantage: 1. They are more easily, surely and cheaply raised. 2. They are maintained, after commencing work, for much less than the cost of keeping horses. 3. They are not subject to many of the diseases of the horse, and to others only in a mitigated degree, and even these are easily cured in the mule. 4. They attain a greater age, and their average number of working years is probably twice that of the horse.

In 1860, there were reported to be 6,115,458 horses, and 1,129,553 asses and mules in the Union, no discrimination having been made between the latter, of which 1,000,000 may be mules. Suppose the total number of both are the same at the present time, and if we deduct one-third, and the odd fraction of the number of horses, supposed to be required for the purposes of breed, fancy, etc., we shall then have 4,000,000 horses, whose places may be equally well supplied by the same number of mules. We have seen that Mr. Hood, of Maryland, estimates the expense of a working horse at $44 per annum, (not an over estimate for the Atlantic States,) while that of the mule is $22. The difference is $22, which it is proper to reduce to meet the much lower rate of keeping at the west. If we put the difference at $10, we shall find the saving in the keep, shoeing, farriery, etc., by substituting mules for the 4,000,000 horses that can be dispensed with, will be $40,000,000 per annum. But this is not all. The working age of the horse will not exceed an average of eight years, while that of the mule is probably over sixteen. To the difference of keep then, must be added the annual waste of the capital invested in the animal. A mule is more cheaply raised to working age than a horse, but allowing them to cost equally, we shall have the horse exhausting one-eighth or three-twenty-fourths of his capital annually for his decay, when the mule is using up but one-sixteenth; and if we allow $48 as the first cost of both

animals, we shall find the horse wasting $6 annually for this item, while the mule deteriorates but $3, making an additional item of $12,000,000 more; and an aggregate of $52,000,000 as the annual saving to the United States by substituting good mules for three-fourths of the horses now used in this country.

The foregoing remarks are the *mule* side of the argument in their favor against the horse, presuming that the facilities of obtaining, or rearing the mule, and its keeping, is equal to that of the horse. But such is not the fact. Mule breeding is chiefly confined to particular localities and States west of the Allegany mountains.

All through the United States, irrespective of locality, horses are universally kept and bred, and they are fitted for all kinds of farm labor, as well as the road, and easily managed by men, boys, and even women and girls. They are docile, tractable, kind, and gentle, as a rule. Therefore they are readily bred and reared, and easily accessible to every one needing them. Mules are not so. Breeding jacks are seldom kept out of the mule breeding districts; therefore mules cannot be bred by the common farmer out of those districts, and the only way he can obtain them is by purchase, which he has not always the ability to do, where, within his own immediate means, and on his own farm he can raise more or less colts, either for his own use or for sale.

Aside from this, there is no *pleasure* in driving a mule for any labor, except the mere drudgery of the draught, either in farm or road work. He is obstinate, quarrelsome, tricky, when not in constant use; often treacherous, breachy in jumping and throwing fences when in pastures, and safe nowhere but in the stable, when not at work. Therefore a good stock of patience and smooth temper is required on the part of the driver of mules. The whole question may be summed up in this: when *economy* is the sole governing object, in slow, steady, pertinacious labor, the mule is unquestionably the cheapest and most serviceable beast; but in all the varieties of farm or road work, the horse is the most desirable, and such being the case most men are willing to

forego the increased risk, expense, and contingencies of the horse, for the superior gratification of using him.

COMPARATIVE ECONOMY OF HORSE AND OX LABOR.

This is a question which has been often discussed, and when with candor, the conclusion generally has been in favor of ox labor. The different employments, the variety of situation, the season, and the kind of stock reared on the farm, are all questions which should be fully considered in arriving at their true comparative advantages. Most farmers would find it for their interest to keep teams of each, where there is employment for more than one; or if this be not the case, the preference should be given to that which is best suited in all respects to their particular position. If work upon the road is required, a horse team will generally be best. Their superiority will consist principally in their greater speed, for even with a heavy load, they will be able to trot occasionally, and when driven without it, they may increase their pace to nearly double the natural gait of the ox. This will amount to a large annual saving in the time of the driver when steadily employed. The same is true when removing manure or crops on the farm to remote distances, over a smooth surface, which admits of trotting with the empty wagon. Harrowing ought always to be done with a quick team, as a violent stroke of the teeth breaks the clods, and pulverizes the earth much better than when slowly dragged along. But we assume in this comparison, that oxen shall not only be well adapted to their work by their natural formation, like the Hereford, the Devon, and others equally good, but that they be also well broke, well managed, accustomed to quick movements, and as well fed and looked after as horses. We shall then find their walk equal to a quick horse team, and that in this case, the horse will have no advantage over the ox in harrowing. For plowing, the teams are on a par, as a good ox team will do as much in a day in cool weather, as horses. Where the loads can be tipped, as in unloading manure in the field, or roots through a scuttle, or in heaps,

the ox cart, or the two-wheel single horse cart is best, as all the labor of throwing out by hand is avoided.

The situation of the farm may materially affect this estimate. In a warm climate, horses, and more especially mules, would be more serviceable than oxen, as they are capable of enduring much greater heat with impunity. If the farm be small and convenient to market, the labor may in general be best accomplished by oxen, as little traveling will be required. So too, if the land be stony or rough, the plowing and harrowing will be more kindly and patiently done by oxen than by spirited horses. Other considerations will suggest themselves as affecting the comparative economy of this labor.

The time of work is to be fully considered. If much and heavy work be required in summer, as is often the case in plowing extensive wheat farms, horses are to be preferred; yet if the ox-team be started at early dawn, and worked briskly four or five hours, and then turned out to rest with a supply of suitable food, they may again commence when the extreme heat has abated, and accomplish a day's work that few horses will exceed. During the season of muddy roads, the horse, with his broad, compact foot and longer leg, has a decided advantage over the ox. If the ox draws by the yoke, (which on the whole is the best mode,) he is liable to a sore neck when working in wet or snowy weather, and at such times he is over-matched by his competitor. This is partially remedied by applying a decoction of white or yellow oak bark.

The kind of stock raised on the farm has an important bearing on this question. Some farms are devoted to rearing horses, and some exclusively to rearing cattle. These sometimes remain on hand after they are fit for market, from the want of a profitable demand. They can then be employed not only without injury, but in consequence of the thorough training thus secured, with positive benefit to their future value. Even if intended for the shambles, the well developed ox may advantageously be put to light work at three, after which, it may be gradually increased

till he is six or eight, and during all this time he will be improving, and after doing an early spring's work, he may then be turned on to good pasture, and if fóllowed with proper stall-feeding, he will in the latter part of the winter or spring, yield a tender, better flavored and more profitable carcass than can be procured by any other mode of fattening.

The first cost of oxen is less than that of horses, and they are at all times cheaply reared on the coarser herbage of the farm. The expense of working-gear, tackle and shoeing, is much less than with horses. They are subject to fewer diseases, and these are more within the reach of ordinary medicines. The cost of food is also less, and while the horse is depreciating, the ox is increasing in value till eight or nine years old. Accidents are less frequent with oxen, from their slower movements ; and when they occur, the ox may be turned out to fatten, and still be worth as much for this purpose as for the yoke. A permanent injury to the horse, is perhaps a total loss of the beast, with a large farrier's bill in addition, for which there is nothing to liquidate it but the hide. The small farmer can make out a most serviceable team, by putting a single horse before a yoke of cattle. If well trained, they will soon accommodate themselves to each other's pace, and work as advantageously together, as an entire team of either animals would do alone. Bulls are frequently put to the draught, and when they have not other services that fully test their powers, they cannot be better employed. Heifers and cows are sometimes worked, but hitherto they have not been used to any extent in this country. In the absence of other animals, they might perform light work to advantage, but severe labor would stint their growth or impair their milk beyond the benefit derived from it. The *spayed heifer* is an exception to the foregoing remark, and by many, is esteemed even more useful than an ox of equal weight. We have no definite statements of the comparative money value of the labor of oxen and horses. But in England, repeated trials have been made, and while some have found no advantage in the employment of oxen over horses,

others have proved them decidedly superior. One Anglesey farmer, found in an experience of three years, with twelve horses and twenty oxen, which accomplished an equal amount of work, that he had saved by the latter £236, or nearly $1,180. This result proves the subject to be one of sufficient importance, to justify the closest investigation of every farmer to determine for himself, the comparative value of ox, horse or mule labor.

After all, the character of the farm, the kinds of crops raised, and the various other work to be performed, must decide the policy and economy of employing either ox, horse or mule labor. The greatest impediment to ox labor on the farm, is their inability to endure our intensely warm summer weather, and to obtain good ox teamsters.

CHAPTER XX.

SWINE.

THE hog is a cosmopolite of almost every zone, though his natural haunts, like those of the hippopotamus, the elephant, the rhinoceros and most of the thick skinned animals, are in warm climates. They are most abundant in China, the East Indies, and the immense range of Islands which extend over the whole Southern and Pacific Oceans; but they are also numerous throughout Europe, from its southern coast to the Russian dominions within the Arctic. In the United States, they have been an object of attention since its earliest settlements, and whenever a profitable market could be found for pork abroad, it has been exported to the full extent of the demand. For twenty years following the commencement of the general European wars, soon after the organization of our national government, it was a comparatively large article of export; but since then, exports to any extent, have not been justified, until within the last twenty-five years, in which a material reduction in the British import duty on pork, lard, hams, beef, etc., has again brought it up as a prominent article of commerce with that country. The recent use which has been made of the carcass in converting it into lard oil, has still further increased its consumption. Swine are reared in every part of the Union, and when properly managed, always at a fair profit. At the extreme North, in the neighborhood of large markets, and on such of the southern plantations as are particularly suited to sugar or rice, they are not profitable, beyond the number required for the consumption of the coarse or refuse food produced. While pork remains at a moderate price, it can only

be advantageously raised on a large scale on good soils, as it is such only that yield heavy crops of grain, roots, etc., which are essential to fattening it. Swine are profitable in connection with a dairy or orchard, as with little additional food besides what is thus afforded, they can be put into good condition for the butcher. It is on the rich bottoms, and other lands of the West, where Indian corn is raised in profusion, and at small expense, that they can be reared in the greatest numbers and yield the largest profit. The extensive and fertile States west of the Alleganies, have for many years, taken the lead in the production of swine; and it is probable their climate and soil, which is peculiarly suited to their rapid growth, as well as that of their appropriate food, will enable them forever to remain the leading pork producers of the North American Continent.

The Breeds of Swine cultivated in this country are numerous, and like our native cattle, they embrace many of the best, and a few of the worst to be found among the species. Great attention has for many years been paid to their improvement in the Eastern States, and nowhere are there better specimens than in many of their herds. This spirit has rapidly extended westward and southward, and among many of the intelligent farmers, who make them a leading object of attention, on the rich corn grounds of the West, the swine have attained a great degree of excellence. This has been accomplished by the introduction and perpetuity of some of the distinct races, and in the breeding up to a desirable size and aptitude for fattening, from such meritorious individuals of the breeds, or their crosses, as have come within their reach.

Among the different breeds of swine imported here within the present century, are the spotted black and white *Chinese*—among the earliest—and the white *Byefield*, or Grass breed, both small-boned, chunky varieties. These were, in the Eastern States, crossed on to the coarse, rangy hogs, then common throughout the country, and considerably improved their shapes and the quality of their flesh. They were followed, years afterwards,

by the *Leicester*, a large white, rather coarse, but rangy animal. All these crosses were variously intermixed, and bred much to the improvement of the old race, and perhaps even the new breeds themselves.

But probably the most marked improvement made upon the swine family, was by the introduction of the *Berkshires* about the year 1832, by two English farmers, Mr. Brentnall, into Orange, and Mr. Hawes, into Albany counties, New York. This was, at the time, considered the best English breed for all uses in England, and built up from a cross of the small, plump China pig, on the ancient Berkshire stock, a large, stout, but well made beast of a dark sandy and white color. The improved breed were chiefly black, or deep plum color, mixed with a little white, round, long, and full in the carcass, with full shoulders, long bodies, and round plump hams. They soon became very popular, and widely disseminated all over the country. Several other importations rapidly followed those of Messrs. Brentnall and Hawes, but by far the largest and finest importation of this breed was made in the year 1841, by Mr. A. B. Allen, then residing at Buffalo, N.Y He selected them in England, himself, in the county of Berkshire, from the most noted breeders. We have never seen specimens of the breed excelling, or scarcely equaling in size and symmetry, that importation, although many Berkshires have been since imported by other parties. The produce of that importation of Mr. Allen, was more widely spread throughout the several States, East, West, North and South, than any other, and added greatly to the popularity of the breed, and to the improvement of our swine generally. Mr. Allen, at the same time, brought out several of the *Kenilworths*, a large white breed which he found in the vicinity of Kenilworth castle, which he afterwards bred and distributed, chiefly in the Western States. Owing, however, to the unprecedented low price of meats which, within a few years afterwards, followed those importations—pork falling to the very low price of two to three cents a pound, by the carcass, in our chief meat markets—the inducement to their extension fell off, and

their further choice breeding almost altogether ceased. But the stock was here, and the gradual improvement of most of our swine families continued.

As prices of meats afterwards advanced, further importations were made, not only of *Berkshires*, but *Essex* (black,) *Suffolks* (white,) of the smaller breeds, and the *Yorkshires* (white,) *Cheshires* (white,) of the larger breeds, and *Neapolitans*, (mostly black,) by Mr. L. G. Morris, of Westchester, Mr. Samuel Thorne, Mr. C. S. Wainwright, of Duchess counties, N. Y., the late Mr. James G. King, and Mr. John C. Jackson, of New York city. Several other importations of Suffolk, and other breeds, were made by Mr. Stickney, of Boston, and others since, whose names are not now recollected, in different Eastern cities. Very fine Yorkshires were imported by Mr. Brodie, of Jefferson county, N. Y., and some Canadian farmers. These latter were of the largest breed yet imported, very long, fine, and rangy in figure. All these breeds have been widely distributed, and greatly to the improvement of the prime stock of our country.

Breeding.—Swine should not be allowed to breed before twelve or fifteen months old, unless the animals are large and coarse, when they may be put to it somewhat younger. Not only choice individuals, but such as are well descended, should be selected for the purpose of breeding. The sow should be in good condition, but not fat, nor approaching to it, and a proper degree of exercise is essential to the development of the fœtus and the health of the parent; for which reason she should have an extended range connected with her pen. The sow goes with young about one hundred and fourteen days. A week before her time comes round, a comfortable, quiet place should be prepared for her under cover, and well protected from cold, if the weather be severe, or if warm, a range in a pasture with an open shed to retire to, is sufficient. Too much litter for bedding must be avoided, and no change or disturbance of the sow permitted till two or three weeks after pigging, as the restlessness thereby produced may result in the loss of the pigs. The sow should be fed

only with a small quantity of the lightest food or thin gruel, for two or three days, nor put on full feed for a week. If inclined to eat her pigs, she should be fed two or three times with raw pork or fresh meat. The pigs may be taught to crack oats or soaked corn after three or four weeks, but those, or any other grains, are much better for being ground, and corn cooked, if possible. Milk is the best food to wean pigs on, where it can be had, and meal mixed gradually as they grow older. The pigs, at this time, should be provided with a trough inaccessible to the dam; they will soon learn to feed on milk and other food, preparatory to weaning. This may take place when they are eight or ten weeks old, and to prevent injury to the sow, let one or two remain with her a few days longer, and when finally removed, if her bag appears to be full, they may be allowed to drain the milk after twenty or thirty hours. The sow should be restricted to a light, dry diet for a few days. At six to eight weeks old, the male pigs, intended for pork, should be castrated.

Raising, Feeding and Fattening.—There are but two objects in keeping swine,—for breeding, and for slaughter,—and their management is consequently simple. Those designed for breeding should be kept in growing condition, on light food, and have every advantage for exercise. Such as are destined exclusively for fattening, ought to be steadily kept to the object. It is the usual practice, with extensive pork raisers, in this country, to let spring pigs run at large for the first fifteen months, with such food as is convenient, and if fed at all, it is only to keep them in moderate growth till the second autumn. They are then put up to fatten, and in the course of sixty or ninety days, are fed off and slaughtered. During this brief period, they gain from fifty to one hundred per cent. more of dressed weight, than in the fifteen or eighteen months preceding; nor even then do they yield a greater average weight than is often attained by choice, thrifty pigs, which have been well fed from weaning to the age of eight or ten months. Three pigs, when precisely seven and a half months old, dressed 230, 235 and 238½ pounds.

Two others, at nine months, dressed 304 and 310 pounds. Three others, seven months and twenty-seven days old, weighed 240, 250 and 257 pounds net. Innumerable instances could be adduced of similar weights, gained within the same time, with a good breed of animals under good treatment. We have no one accurate account of the food consumed, so as to determine the relative profit of short or long feeding. But that an animal must consume much more in eighteen or twenty months to produce the same quantity of dressed meat, which is made by others of eight or ten months, does not admit of a doubt. We have seen that an ox requires but little more than double the quantity of food to fatten, that is necessary for supporting existence. If we apply this principle to swine, and state the quantity of food which will fatten the pig rapidly, to be three times as great as for the support of life, we shall find that the pig will fatten in seven months, on the same food he would consume to keep him alive for twenty-one. This is based on the supposition that both animals are of equal size. But the pig that matures and is slaughtered at seven months, has only a moderate capacity for eating. During the early stages of his growth, his size, and the consequent incapacity of the digestive organs, prevent the consumption of the same quantity which the larger animal requires; and his accumulating fat, his limited respiration, consequent upon the compression of his lungs, and his indisposition to exercise, all conspire to keep the consumption of food within the smallest possible limit. This result, in the absence of any experiment, must be conjectural entirely; but we believe that experiments will show that of two thrifty pigs from the same litter, one of which is properly fed to his utmost capacity for seven months, and the other fed with precisely double the quantity of similar food for twenty-one months, the first will yield more carcass and of a better and more profitable quality than the latter, which has consumed one hundred per cent. the most. The food is only one item in this calculation. The oldest requires the most attention, is liable to more accidents and disease, besides the

loss of interest. Some good farmers assert, that by far the cheapest mode of wintering pigs is in the pork barrel. We can readily anticipate one objection to this practice, which is the want of food in the early part of the season to fatten them. This can be obviated by reserving enough of the previous year's grain, to keep the animal in a rapidly thriving state till the next crop matures sufficiently to feed. Spring pigs to be fatted, at a few months old, should be of the smaller breeds, which acquire an early growth, as the China, Essex or Suffolk. The larger breeds require a longer time for maturity and to take on their full quantity of flesh.

In the rich corn regions of the Western States, the old wasteful way of turning swine into the corn fields to fatten, is now mostly discontinued from the increased value of the harvested grain, and it is fed to them from the harvest wagon, or crib. But penning them under shelter, and grinding and cooking the food, would be more economical. If fattened early in the season, they will consume less food to make an equal amount of flesh than in colder weather; they will require less attention, and generally early pork commands the highest price in market.

It is most economical to provide the swine with a fine clover pasture to run in during the spring and summer, and they ought also to have access to the orchard, to pick up all the unripe and superfluous fruit that falls. They should also have the wash of the house and the dairy, to which add meal, and sour in large tubs or barrels. Not less than one-third, and perhaps more, of the whole grain fed to swine, is saved by grinding and cooking, or souring. Yet care must be observed that the souring be not carried so far as to injure the food by putrefaction. A mixture of meal and water, with the addition of yeast, or such remains of a former fermentation as adhere to the side or bottom of the vessel, and exposure to a temperature between 68° and 77° will produce immediate fermentation. In this process there are five stages. The *saccharine*, by which the starch and gum are converted into sugar; the *vinous*, which changes the sugar into alcohol; the *mucilaginous*, sometimes taking the place of the vinous,

and occurs when the sugar solution, or fermenting principle is weak, producing a slimy, glutinous product; the *acetic*, forming vinegar, and the *putrefactive*, which destroys all the nutritive principles and converts them into a poison. The precise point in fermentation when the food becomes most profitable for feeding, has not yet been satisfactorily determined; but that it should stop short of the putrefactive, and probably the acetic, is certain.

The roots for fattening animals ought to be washed, and steamed or boiled, and when not intended to be fermented, the meal ought always to be scalded with the hot roots. Such a quantity of salt as will not scour, may be added to every preparation for swine. Potatoes are the best roots for swine; then parsnips, orange or red carrots, white or Belgian sugar beets, mangold-wurzel, in the order mentioned. The nutritive properties of turnips are diffused through so large a bulk, that we doubt if they can ever be fed to fattening swine with advantage; and they will barely sustain life when fed to them uncooked. There is a great loss in feeding roots to fattening swine, without cooking. The animal machine is an expensive one to keep in motion, and it should be the object of the farmer to put his food in the most available condition, for its immediate conversion into fat and muscle. Swine ought to be kept perfectly dry and clean, and provided with a warm shelter, to which they can retire at pleasure. This will greatly hasten the fattening and economize the food. A hog ought to have three apartments, one each for sleeping, eating, and evacuations, of which the last ought to occupy the lowest, and the first the highest level, so that nothing shall be drained, and as little carried into the first two as possible. They must be regularly fed three times a day, and if there is a surplus, it must be removed at once. If they are closely confined in pens, give them as much charcoal twice a week as they will eat. This corrects any tendency to disorders of the stomach. Rotten wood is an imperfect substitute for charcoal. Greaves, scraps or cracklings, as they are variously called, the residuum of rough lard or tallow after expressing the fat, are a good change and an economical food. Some animal food,

although not essential, is always acceptable to swine. When about to finish them off, many feed for a few weeks on hard corn. This is proper when slops or indifferent food has been given, and meal cannot be conveniently procured; but when fattened on sound roots and meal, it is a wasteful practice, as the animal thus falls behind his accustomed growth. It is better to give him an occasional feed of the raw grain, for a change, and to sharpen his appetite.

The products furnished by swine are numerous. Every part of the carcass is used for food, and it admits of a far greater variety of preparation for the table, than any other flesh. From the remotest antiquity to the present time, and in every grade of barbarous and civilized life, it has been esteemed as one of the choicest delicacies of the epicure. *Lard oil* has within a few years, given to pork a new and profitable use, by which the value of the carcass is greatly increased. At some of the large pork packing depots of the West, one-third of the whole quantity has, in some years, been thus disposed of, which withdrew a large amount of pork from the market, and prevented the depression which must otherwise have occurred.

Stearine and Oleine.—Lard, and all fatty matters, consist of three principles, of which stearine contains the stearic and margaric acids, both of which, when separated, are solid and used as inferior substitutes for wax or spermaceti candles. The other, oleine, is fluid at a low temperature, and in American commerce, is known as lard oil. It is very pure and extensively used for machinery, and most of the purposes for which olive and spermaceti oils are used.

Curing Hams and Pork.—After dressing, the carcass should be allowed to hang till perfectly drained and cool, when it may be cut up and salted. The usual way is to pack the pork in clean salt, adding brine to the barrel when filled. But it may be dry salted, by rubbing it in thoroughly on every side of each piece, with a strong leather rubber, firmly secured to the palm of the right hand. The pieces are then thrown into heaps and sprinkled

with salt, and occasionally turned till cured; or it may at once be packed in dry casks, which are occasionally rolled to bring the salt into contact with every part. *Hams and shoulders* may be cured in the same manner, either dry or in pickle, but with differently arranged materials. The following is a good pickle for two hundred pounds. Take 14 lbs. of Turk's Island or other *pure* salt, ½ lb. of saltpeter, 2 qts. of molasses, or 4 lbs. of brown sugar, with water enough to dissolve them. Bring the liquor to the scalding point, and skim off all the impurities which rise to the top. When cold, pour it upon the hams, which should be perfectly cool but not frozen, and closely packed; and if not sufficient to cover it, add enough pure water for this purpose. Some extensive packers in the great slaughter houses, who send choice hams to market, add pepper, allspice, cinnamon, nutmegs or mace, and cloves. The hams may remain six to eight weeks in this pickle, then hung up in the smoke house, with the small end down, and smoked from ten to twenty days, according to the quantity of smoke. The fire should not be near enough to heat the hams. In Holland and Westphalia, the fire is made in the cellar, and the smoke carried by a flue into a cool, dry chamber. This is undoubtedly the best method of smoking. The hams should at all times be dry and cool, or their flavor will suffer. Green sugar maple chips are best for smoke; next to them are hickory, sweet birch, corn cobs, white ash, or beech. The smoke house is the best place to keep hams till wanted. If removed, they should be kept cool, dry and free from flies. A canvas cover for each, saturated with lime, which may be put on with a whitewash brush, is a perfect protection against flies. When not to be kept long, they may be packed in dry salt, or even in sweet brine, without injury. A common method is to pack in dry oats, baked sawdust, grain or hay, chaff or dry ashes.

The sides, or rib pieces of light pork carcasses, are extensively made into bacon. They are cured by salting them in piles on forms or benches, as hams and shoulders, and curing them by smoking. They make an excellent and convenient meat.

CHAPTER XXI.

POULTRY, Etc.

Choice varieties of fowls add a pleasant feature to the farm premises. They engage the attention and sympathy of the juvenile farmers, and the time bestowed in the poultry yard keeps them from mischief, is an agreeable and salutary relief for toil and study, and elicits the taste, the judgment, and the kindlier feelings of humanity, which are to be matured in the future accomplished breeder. When properly managed, poultry are a source of considerable profit, yielding more for the food they consume, than any other stock, although their value is not often considered. The agricultural statistics of the United States, for 1839—thirty years ago—gave its value at over $12,000,000, and the current value of the poultry in the United States is now probably twenty millions of dollars, and its annual product in eggs and flesh is much greater. It is estimated by McQueen, that the poultry of England exceeds $40,000,000, and yet McCulloch says, she imports 60,000,000 eggs annually from France, (McQueen states it at near 70,000,000;) and from other parts of the continent, 25,000,000; besides 80,000,000 imported from Ireland. The people of the United States are much larger egg and poultry consumers than the English, and thus they are a considerable object of agricultural attention, and assume an important place among the other staples of the farmer.

HENS, OR BARN-DOOR FOWLS,

Are the most numerous and profitable, and the most generally useful of the feathered tribe. The hen is peculiarly an egg-producing bird. She has the same predisposition for laying, that the

cow has for secreting milk. Some breeds are better adapted for this object than others, but in all that have ever come within our notice, the proper food and circumstances are alone wanting, to produce a reasonable quantity of eggs. The egg consists of three distinct parts: the shell, the white, and the yolk. A good-sized egg will weigh 1,000 grains, of which about 107 are shell, 604 are white, and 289 are yolk. Of the shell, 97 per cent. is carbonate of lime, 1 per cent. phosphate of lime and magnesia, and 2 per cent. albumen. The white consists of 12 per cent. of albumen, 2.7 of mucus, 0.3 of salts, and 85 of water. The yolk has about 17.4 per cent. of albumen, 28.6 of yellow oil, 54 of water, with a trace of sulphur and phosphorus. The above are the constituents of eggs, which have been formed when the bird has free access to the various articles which constitute her natural food. But they vary with circumstances. When full fed and denied all access to lime, she will form an egg without the shell, and deliver it enclosed in the membrane or sack which always surrounds the white, when covered by the shell. When scantily fed, they will frequently lay; but from a deficiency of nutriment, the egg will be meagre and watery, and possess but a small portion of the nutritious qualities peculiar to them. To produce the largest number of good eggs, several conditions are important; and they must especially have an abundance of the right kind of food. This is the most readily obtained in part from animal food. In warm weather, when they have a free range, they can generally supply their wants in the abundance of insects, earth worms, and other animal matters within their reach. The large proportion of albumen contained in their eggs, requires that much of their food should be highly nitrogenized, and when they cannot procure this in animal matter, it must be given in grains containing it.

If to the usual qualities of hens, a breed of peculiar elegance, of graceful forms, and beautiful plumage, be added, together with entire adaptation to the economical purposes required, good layers, and good carcass, we have a combination of utility, luxury,

and taste in this bird, which should commend them as general favorites. They can everywhere be kept with advantage, except in dense cities. A hen that costs a few shillings, if provided with a suitable range, will consume fifty to eighty cents' worth of food, and produce from one hundred to two hundred eggs per annum, worth two or three times the cost of feed and attention.

THE FOOD of hens may consist of different kinds of grain, either broken, ground, or cooked; roots, and especially boiled potatoes, are nutritious and economical; green herbage, as clover and many of the grains, chickweed, lettuce, cabbage, etc., will supply them with much of their food, if fresh and tender. Though not absolutely essential to them, yet nothing contributes so much to their laying, as unsalted, animal food. This is a natural aliment, as is shown by the avidity with which they pounce on every fly, insect or earth worm which comes within their reach. It would not of course pay to supply them with valuable meat, but the blood and offal of the slaughter houses, refuse meat of all kinds, and especially the scraps or cracklings to be had at the melters' shops, after soaking for a few hours in warm water, is one of the best and most economical kinds of food. Such, with boiled meal, is a very fattening food. Grain is at all times best for them when ground and cooked, as they will lay more, fat quicker, and eat much less when it is fed to them in this state; and it may be thus used unground, with the same advantage to the fowls, as if first crushed, as their digestive organs are certain to extract the whole nutriment. All grain is food for them, including millet, rice, the oleaginous seeds, as the sunflower, flax, hemp, etc. It is always better to afford them a variety of grain, where they can procure them at their option, and select as their appetite craves.

They are also fond of milk, and indeed scarcely any edible escapes their notice. They carefully pick up most of the waste garbage around the premises, and glean much of their subsistence from what would otherwise become offensive, and by their destruction of innumerable insects and worms, they render great

assistance to the gardener. Of course their ever busy propensity for scratching, is indiscriminately indulged just after the seeds have been planted and while the plants are young, which renders it necessary that they be confined in some close yard for a time; yet this should be as capacious as possible. Their food, if cooked, is better when given to them warm, not hot; and no more fed at a time than they will pick up clean. Besides their food, hens ought to be at all times abundantly supplied with clean water, egg or pounded oyster shells, old mortar or slaked lime. If not allowed to run at large, where they can help themselves, they must also be furnished with gravel to assist their digestion; and a box or bed of ashes, sand and dust, is equally essential to roll in for the purpose of ridding themselves of vermin.

The hen-house may be constructed in various ways to suit the wishes of the owner, and when tastefully built, it is an ornament to the premises. It should be perfectly dry throughout, properly lighted by glass windows in the roof, if possible, and capable of being made tight and warm in winter, yet afford all the ventilation desirable at any season. In this, arrange the nests in boxes on the sides, in such a manner as to humor the instinct of the hen for concealment when she resorts to them. When desirable to set the hen, these nests may be so placed as to shut out the others, yet open into another yard or beyond the enclosure, so that they can take an occasional stroll and help themselves to food, etc. This prevents other hens laying in their nests, while sitting, and may be easily managed, by having their boxes hung on the wall of the building, with a movable door made to open on either side at pleasure. Hens will lay without a nest egg, but when broken up, they ramble off and form new nests, if they are not confined. They will lay if kept from the cock, but it is doubtful if they will thus yield as many eggs. Hens disposed to sit at improper times, should be dismissed from the common yard, so as to be out of reach of the nests, and plentifully fed till weaned from this inclination.

The chickens require to be kept warm and dry, for the first few days after hatching, and they may be fed with hard boiled eggs,

crumbs of bread or pudding, and milk or water, and allowed to scratch in the gravel in front of the hen, which should be confined in a coop for the first three or four weeks, after which, they may be turned loose, when they will thrive on anything the older ones eat. Many use them for the table when they are but a few weeks old; but they are much less valuable for this purpose, till they have attained to near or quite full maturity. The white-legs are preferred by some, from the whiteness and apparent delicacy of the meat; but the yellow and dark-legged are good. The color of the feathers does not seem to affect the quality of the flesh or their character for laying. If we consider the principle of the absorption and retention of heat, we should assume the white coat to be best, as it is cóolest in summer when exposed to the sun, and warmest in winter. Yet some of the white breeds are delicate and do not bear rough usage or exposure.

VARIETIES.—Aside from the common dunghill fowl which embraces many differences in shape, size, color and appearance, there are many distinct breeds which more or less attract our poultry fanciers in their choice of selection. These are so numerous that our space will permit no extended descriptions, and we must refer the reader to some of the several treatises on poultry management for particulars, wherein they are fully discussed. We may remark, however, that among the leading breeds, are the Asiatic of several varieties, as the *Bhrama*, *Shanghai*, *Chittagong;* the *English Games* and *Dorkings;* the *Spanish*, *Poland*, *Bantam*, and many others; and of late, some of the French varieties, as *Créve-Cœur*, *La Fleche*, *Houdan*, *etc.*

The late extraordinary interest in poultry breeding and selections which has spread throughout the country, called in derision, "the poultry fever," has proved of wonderful benefit to the quality of our barn-door fowls, in rearing them from a low estate to the highest grade of excellence, both in their production, and edible qualities, as well as ornament to the rural premises.

THE DISEASES of hens are not numerous or complicated, and may be mostly avoided by proper treatment and food, which are indicated with sufficient minuteness in the foregoing observations.

Gapes or pip is generally owing to drinking unwholesome or dirty water. Remove the white blister on the tip of the tongue, and wash with sharp vinegar, diluted with warm water; or compel the bird to swallow a large lump of fresh butter, mixed with Scotch snuff. It has been removed by opening the mouth and forcing a pigeon feather, with a tuft of the feather left on the end, the other being stripped off, down the wind-pipe, and gently turning it as withdrawn, to be repeated the following day if necessary. This detaches large numbers of slender red worms, collected in the larynx of the throat, which impede respiration and swallowing. A little spirits of turpentine mixed with the food is a preventive; as are also clean, white-washed premises, and good food. Feed for a few days with light food, soaked bran, and cabbage or lettuce chopped fine. *Roup, Catarrh* or *swelled head*, is shown by feverish symptoms, swollen eye-lids, (frequently terminating in blindness,) rattling in the throat, and temporary strangulation. These are accompanied by a highly offensive watery discharge from the mouth and nostrils, loss of appetite, and much thirst. They should be placed near the fire; their head bathed in warm Castile soap-suds, or milk and water. Stimulating food, as flour or barley-meal, mustard and grated ginger, mixed and forced down the throat, Boswell says, has been effectual in their speedy restoration. This, like many other diseases, is contagious, and when it appears, the bird should be at once separated from the flock. *Flux* is cured by the yolk of an egg boiled hard, and boiled barley soaked in wine or cider. *Costiveness* is removed by giving bran and water with a little honey; or give a small dose of castor oil. *Vermin* are destroyed by giving them clean sand and ashes to roll in, adding a little quicklime if necessary. Crude kerosene oil is perhaps the best remedy for lice. Swabbed along the roosts and laying boxes, or on the under feathers of the fowl, it has proved destructive to these vermin. Carbolic acid, or "heavy oil," (a distillation from gas tar,) is also an effectual remedy for vermin, applied in the same manner. Entire *cleanliness* is necessary for the avoidance of this and other dis-

eases. A perfectly *dry* range is also essential, nor should there be too many together, as this is a fruitful source of disease.

THE TURKEY

Was unknown to the civilized world till the discovery of this Continent. It was found here both in its wild and domesticated state, and still occupies the whole range of the Western Hemisphere, though the wild turkey disappears as the country becomes settled. The wild is about the size of the domesticated bird. The color of the male is generally a greenish brown, approaching to black, and of a rich, changeable, metallic lustre. The hen is marked somewhat like the cock, but with duller hues. Domestication through successive generations, has changed the color of their plumage, and produced a variety of colors, black, buff, pure white, or speckled. They give evidence of the comparative recency of their domestication, in the instinct which frequently impels the cock to brood and take care of the young. Nothing is more common than for the male bird to supply the place of the hen, when any accident befalls her, and bring up a family of young chicks with an equally instinctive regard for their helplessness and safety. The flesh of this bird, both wild and tame, is exceedingly delicate and palatable; and though not possessing the high game flavor of some of the smaller wild fowl, and especially of the aquatic, as the canvas-back duck, etc., it exceeds them in its digestibility and healthfulness. The turkey is useful principally for its flesh, as it seldom lays over a nest full of eggs at one clutch, when they brood on these and bring up their young. If full fed, and their first eggs are withdrawn from them, they frequently lay a second time. We have had them lay throughout the summer and into late autumn.

Breeding.—Those intended for breeders should be compact, vigorous and large, without being long-legged. They should be daily, yet lightly fed through the winter, on grain and roots, and some animal food is always acceptable and beneficial to them. They are small eaters, and without caution will soon get too fat.

One vigorous male will suffice for a flock of ten or twelve hens, and a single connection is sufficient for each. They begin to lay on the approach of warm weather, laying once a day, or every other day, till they have completed their clutch, which in the young or indifferently fed, may be ten or twelve, and in the older ones, sometimes reaches twenty. The hen is sly in secreting her nest, but usually selects a dry, well protected place. She is an inveterate sitter, and carefully hatches most of her eggs. The young may be allowed to remain for twenty-four hours without eating, then fed with hard boiled eggs, made fine, or crumbs of wheat bread. Boiled milk, curds, buttermilk, etc., are food for them. As they get older, oat or barley meal is suitable, but Indian meal, uncooked, is hurtful to them when quite young. They are very tender, and will bear neither cold nor wet, and it is of course necessary to confine the old one for the first few weeks. When able to shift for themselves, they may wander over the fields at pleasure; and from their great fondness for insects, they will rid the meadows of innumerable grasshoppers, etc., which often do incalculable damage to the farmer. Early chickens are sufficiently grown to fatten the latter part of autumn or the beginning of winter, which is easily done on any of the grains or boiled roots. The grain is better for cooking. They require a higher roosting place than hens, and are impatient of too close confinement, preferring the ridge of a barn, or a lofty tree, to the circumscribed limits of the ordinary poultry house. When rightly managed and fed, turkeys are subject to few maladies, and even these, careful attention will soon remove.

THE PEACOCK AND GUINEA HEN.

The peacock is undoubtedly the most showy of the feathered race. It is a native of the southern part of Asia, and is still found wild in the islands of Java and Ceylon, and some parts of the interior of Africa. They are an ornament to the farm premises, and are useful in destroying reptiles, insects and garbage,

but they are quarrelsome in the poultry yard and destructive in the garden. Their flesh is coarse and dark, and they are worthless as layers. The brilliant silvery green, and their ever-varying colors give place to an entire white in one of the varieties.

The Guinea hen is a native of Africa and the southern part of Asia, where it abounds in its wild state. Most of them are beautifully and uniformly speckled, but occasionally they are white on the breast, like the Pintados of the West India Islands, and some are entirely white. They are unceasingly garrulous, and their excessively pugnacious character renders them uncomfortable inmates with the other poultry. Their flesh, though high colored, is delicate and palatable, but, like the peacock, they are indifferent layers. Both are natives of a warm climate, and the young are tender and rather difficult to rear. Neither of these birds are general favorites, and we omit further notice of them.

THE GOOSE.

There are many varieties of the goose. Main enumerates twenty-two, most of which are wild; and the tame are again variously subdivided. The *common white* and *gray* are the most numerous and profitable. The *white Bremen* is much larger, often weighing over twenty pounds net. It is of a beautiful snowy plumage, is domestic and reared without difficulty, though not as prolific and hardy as the former. The *China goose* is smaller than the gray, and one of the most beautiful of the family, possessing much of the gracefulness and general appearance of the swan. There are three varieties of these in the United States: the small brown, with black bill and legs; the larger gray, with black bill and reddish legs; and the pure white, with orange bill and legs. It is prolific and tolerably hardy, but has not thus far been a successful rival with the first. The *Guinea* or *African goose* is the largest of the species. It is a majestic and graceful bird, and very ornamental to water scenery. Several other varieties are

domesticated in the United States. The finest goslings for the table we have ever reared, or seen, were a cross from the China gander and common gray goose. They are very hardy and easy to raise.

Breeding.—Geese pair frequently at one year old, and rear their young; but with some kinds, especially of the wild, this is deferred till two and sometimes three. They require a warm, dry place for their nests, and when undisturbed they will sit steadily, and if the eggs have not been previously chilled or addled, they will generally hatch them all, if kept on the nest. To insure this, it is sometimes necessary to withdraw the first hatched, to prevent the old ones wandering before all are out. They should be kept in a warm, sheltered place, till two or three weeks old, if the weather be cold or unsettled. The best food for the goslings is barley or oat, or Indian meal boiled, and bread. Milk is also good for them. They require green food, and are fond of lettuce, young clover, and fresh tender grass, and after a few weeks, if they have a free range on this, they will forage for themselves. Geese are not a profitable bird to raise, unless in places where they can procure their own subsistence, or at least during the greater part of the year. This they are enabled to do wherever there are extensive commons of unpastured lands, or where there are streams or ponds, lakes or marshes, with shoal, sedgy banks. In these they will live and fatten throughout the year, if unobstructed by ice and snow.

They may be fattened on all kinds of grain and edible roots, but it is more economical to give them their food cooked. The well-fattened gosling affords one of the most savory dishes for the table. Geese live to a great age. They have been known to exceed forty years. When allowed a free range on good food and clean water, they will seldom get diseased. When well fed, they yield nearly a pound of good feathers in a season, at three or four pluckings, and the largest varieties even exceed this. But plucking is a cruel business, and should not be done closely, and only between the months of May and October. Goslings in-

tended for eating should not be plucked at all until fatted and killed.

DUCKS

Are more hardy and independent of attention than the goose, and they are generally the most profitable. They are omnivorous, and greedily devour everything which will afford them nourishment, though they seldom forage on the grasses, like the goose, when they can procure other food. They are peculiarly carnivorous, and devour all kinds of meat, putrid or fresh, and are especially fond of fish and such insects, worms, etc., as they can find imbedded in the mud or elsewhere. They will often distend their crop with young frogs, almost to the ordinary size of their bodies. Their indiscriminate appetites often render them unfit for the table, unless fattened out of the reach of garbage and offensive matters. An English admiral used to resort to well fattened rats for his fresh meat, when at sea, and justified his taste by saying they were more cleanly feeders than ducks, which were general favorites.

The varieties of ducks are almost innumerable. Main describes thirty-one, and some naturalists number many more. The most profitable for domestic use, aside from the common one, are the *black Cayuga*, the *Aylesbury*, and *Rouen*, all being of much larger size, and richer and more delicate flavor of flesh. They lay profusely in the spring, when well fed, often producing forty or fifty eggs, and sometimes a greater number, if kept from sitting. They are much larger than those of the hen, and equally rich and nourishing, but less delicate. They are careless in their habits, and generally drop their eggs wherever they happen to be through the night, whether in the water, the road, or farm-yard; and, as might be expected from such prodigality of character, they are indifferent sitters and nurses. The ducklings are better reared by sitting the eggs under a sedate, experienced hen, as the longer time necessary for hatching requires patience in the foster-mother to develop the young chick. They should

be confined for a few days, and away from the water. At first they may be fed with bread, or pudding made from boiled oat, barley, or Indian meal; and they soon acquire strength and enterprise enough to shift for themselves, if afterwards supplied with pond or river water. They are fit for the table when fully grown, and well fattened on clean grain. This is more economically accomplished by feeding it cooked. We omit further notice of other varieties, and of the swan, brant, pigeons, etc., as not profitable for general rearing, and only suited to ornamental grounds.

HONEY BEES.

Every farmer, when favorably situated, should keep these useful insects. When successfully bred, they are very profitable, as they obtain their own living and provide stores of surplus honey, with only a reasonable care. To those who adopt their cultivation, we can do no better than refer them to some one of the numerous treatises with which our bookstores abound, for learning all that may be required about them.

CHAPTER XXII.

DISEASES OF ANIMALS.

These are so ramified in their extent, so various in their influences, in many cases so intricate in their natures, and so difficult in treatment, as to induce even the most learned in physiological and medical science to ponder doubtfully before venturing on any settled rules of practice.

Books of farriery and veterinary treatment of farm stock have been written, almost without number, and in many instances by men of ability and undoubted attainments; but so different were their judgments of the kinds of disease under discussion, and their treatment of them, that on searching their different authorities and finding the extreme variance of their prescriptions and practice, one hardly knows what to think, what to do, or, in fact, whether he shall put any faith at all in either one or the other. Veterinary schools have abounded, they now abound—of one sort or another—but many sound, practical, horse and other stock owners avoid them, so chary are they of their prescriptions and treatment of even common diseases. *Surgery* is another matter, both scientific and mechanical, and may be practiced on the lower order of animals by almost any one skillful in his treatment of human anatomy and giving a moderate study to brute conformation.

We might name a score of authorities, of different nationalities, of reputable attainments and approved practice at home, yet discarded elsewhere, and not acknowledged as sound in either theory, prescription, or practice. Doubtless, climate, food and the ordinary treatment of the animals, had much to do with the rules and

practices of the veterinarians in the localities and countries where they worked. What would do or be successful in France, Holland, or Germany, would not answer in Great Britain; and what would be good practice in the latter country, would illy succeed in the other localities; so on this side the ocean, with our different climates, foods and usage, neither of those foreign practices would answer with us. We have but a limited veterinary authority and practice in America. Our schools of the kind are few, and those not always confided in, and yet in every city, village and rural neighborhood are found more or less self-constituted horse and cattle doctors.

We touch the subject with diffidence in our ability to select from the mass of material before us, what to recommend, or what to withhold in the medical treatment of our various farm stock, knowing, as we do, the different opinions of even sound cattle pathologists, physiologists and practitioners. Our treatment of cattle disorders, (and by the term, cattle, we include all farm stock,) should be *American* treatment; that is to say, a treatment found to be successful on our soils and in our climates generally, by those who have given the various diseases to which they are, or have been subject, deliberate study and practice—not empiricism, or quackery, for of these latter every neighborhood has its supply, and too frequently of deleterious influence.

After saying this much, our sagacious reader may conclude we had better say nothing at all. Perhaps so. But our work, after treating of domestic animals as we have, would not be complete without alluding to the subject, or laying down some rules of practice, general in their nature and effect, at least, as well as somewhat in particular for the common diseases to which our stock are or may be subject. This we shall endeavor to do; but not until we have first suggested to all who have the welfare of their stock at heart, the greatest of all considerations: that of *prevention* of disease and accident in the whole routine of usage of the animals under their charge.

Prevention of Diseases and Accidents.—For the safety of his animals, and their successful well-doing, care in handling,

feeding, watering, exercise, work, and stabling is of the highest importance. For this purpose, every preparation for the keeping and accommodation of the stock should, if possible, first be made. If all these cannot be complete, they should be as near to it as circumstances will admit. The golden rule in this category should be: "The merciful man is merciful to his beast," in all things, which includes all of precaution and care for the welfare of the stock within his range. We have known farmers who, during a score of years, had scarcely a sick or ailing creature on their place. We have known others with some one or other continually ailing, maimed, or sick; ever losing them by death, and always deprecating their miserable "luck" in stock. To one intimately acquainted with the different parties and their management, the solution of their varied fortunes would be easy. The first were pains taking, careful husbandmen, using foresight and judgment. The others were neglectful, heedless, paying little attention to their animals; careless in their feed, water, treatment, or shelter; their fences poor, with every facility offering for mishaps and accidents. It is needless to go into particulars, as every one having the means to grow, or keep stock at all, can readily understand what ordinary good care means, and can, if he have the disposition, practice it.

What Authority shall we Adopt?—If all the receipts, nostrums and remedies which we have seen recommended and printed in agricultural papers and other publications—and many of them, no doubt, good and successful in the experience of those who have urged and practiced them—were gathered and recorded, we could fill a scrap-book of voluminous size; but as our space will limit us to a few, and most common only, of the various ailments and diseases to which our animals are subject, we shall resort to that one which, after all our researches, has met with a good share of popular approbation. We say, however, at the threshold, that every stock breeder, and keeper of farm stock of any kind, should provide himself with some competent authority in the way of a book or treatise, (and of that authority himself,

or some experienced man in whom he has confidence, should be the judge,) and have it always at hand for instruction, when a practitioner in the line is not at hand, which latter, we regret to say, is seldom readily found in many localities of our wide-spread community.

There are *partisans* in veterinary treatment, as well as of the human system. Allopathy, homeopathy, and hydropathy each have their advocates and practitioners, and perhaps with about equal success, while it may be truthfully said, those who give the least medicine and permit nature to mainly work its own cures, succeed equally well, if not better than most others. In our practical experience of more than thirty years of stock husbandry, in which horses, neat cattle, sheep and swine have been considerably kept, prevention of disease and accident, through careful attention to them, has been our chief study; and when medicine was resorted to, that of the simplest kind has been used. Leeches, quacks, and "doctors" of various degree have importuned and assailed us, to whom we have paid little attention, and our success has compared most favorably with those whose animals have been attended by "professed" practitioners in the line of medicaments. We have seldom lost an animal where *preventive* care has been bestowed, or timely *mild* medical treatment has been adopted. Nature itself, aided by kindly stimulants, has been our chief reliance for recovery. Blood-letting, after the old fashion, violent purgations—which, however, in some acute inflammatory disorders or attacks, may sometimes be resorted to—have not been registered in our list of ordinary remedies. Within the last fifty, even thirty years, veterinary practice has largely changed from the old way, and, we think, much for the better. In our boyhood days, almost every farmer carried a case of "phlemes" in his pocket, or, wanting that blood-letting instrument, his jack-knife became the substitute, while his home cupboard contained more or less bottles of the vilest drugs, with which to retch and distress the viscera of his poor suffering brutes. These, in most instances, are happily done away with, or so modified in their use as to only

be of occasional resort, while milder remedies have taken their places.

To conclude the matter, after looking over most of the authorities in cattle diseases, we believe "Dadd's American Cattle Doctor" to be a good work. Some of our readers may prefer another. But we earnestly recommend all cattle keepers to possess themselves of *some* competent author, to study him closely; and that, with his own earnest study of the condition of his stock, will aid him best in the welfare of his herd.

DISEASES OF SHEEP.

If properly attended, sheep have few disorders. Dry grounds, sufficient food and water, salt every week or ten days, a reasonable guard against accidents, and shelter during inclement seasons, will usually carry the flock-master, with either small or large numbers, through the year safely. There are, however, diseases which more or less infest our flocks, and should be cured if possible, as they occur. We again refer to Dadd, for the information which our own experience does not supply.

DISEASES OF SWINE.

Dadd also treats of their disorders in his "Cattle Doctor" as with cattle and sheep.

In the treatment of all these different animals, the same caro in keeping and feeding, and precautions against disease, should be adopted as with cattle or horses. Our running remarks, when treating of the varieties of stock, will sufficiently explain the necessity of pains-taking with every living, useful thing appertaining to the success of the farmer. He must have brains of his own, and use them.

TREATMENT AND BREEDING OF HORSES.

Taken in their whole range of detail, horse ailings are almost innumerable; and to treat of them, as they run, an entire volume would be necessary for their enumeration and management.

Dadd, whom we think is as sensible and practical an American authority as we have,—although there are others which may be entitled to equal confidence,—enumerates and treats of more than one hundred and fifty ailments, disorders, and diseases of the body, bowels, bones, skin, and other organs belonging to the horse, comprised in a compact volume of more than four hundred pages of the size of this work. It would be altogether impossible, therefore, to give, within the limited space at our command, any but the faintest allusion even to the most important of them, besides being foreign to the main purposes of this work.

We can do no better, then, than commend the reader at once to the possession—if he have it not already—of some one of the approved American authorities for such instruction as may be necessary in his treatment of the several horse ailments and disorders which may attend his stock.

There are a few simple suggestions, however, which we venture to make to all horse breeders, keepers, and workers, which, if well attended to, will guard against most of the diseases, accidents and misfortunes in their management. The horse is a noble, generous, spirited animal, the most useful in his service of any creature which assists us in his out of door labor, and gratifies our pride and pleasure in his use. He is intelligent, kind, affectionate to his keeper, patient in labor, enduring in effort, and almost always, under kindly treatment, submissive to the will of his master. In ninety-nine cases of a hundred, where he fails to be all these, the blame is not in the horse, but in the wrong treatment which, at some age or other, he has received from those who have handled him.

The first law which should govern all who have to do with horses, from their birth forward, is THE LAW OF KINDNESS; and no law is so often violated as in the want of judgment, descending many times into brutality, in the usage of this noble animal Most people, we trust, use them well; but many, *we know*, are guilty of the most inhuman treatment of their generous natures, and if there be a sin to be accounted for towards one of God's

most useful bounties to humanity, that of ill usage to horse flesh must be reckoned one of the most glaring.

Among the rules which should govern the breeder, or farmer, in his management, should be the following:

1st. Make the young foal gentle, in handling. Let it be well nursed till weaning, which may take place at four or five months old. If the dam be worked, let that work not be too severe, and do not let the foal nurse when she is heated with uncommon exercise or labor.

2d. Feed it plentifully on good grass till the grass season is past, and then on good fodder, such as it will eat, and keep it growing in good condition. Halter-break it the first winter, if possible, and learn it to lead. Continue to feed well on grass and hay, as the seasons occur, until three years old, when it should be broken to the harness, or saddle, as the horse is afterwards intended to be used.

3d. Let the first labors be light and easy, for the young horse is still growing, and severe labor will injure both growth and constitution, which will soon be felt; and if persevered in, he will not last half his allotted years, nor in those years perform near his full amount of labor.

4th. Let his food always be good, wholesome, and nutritious, his times of feeding and watering regular, his shelter warm, well ventilated, and the floor, (which should be of wooden planks, rather than of earth, brick or stone,) on which he stands, kept clean. This latter item is of great importance, as guarding against the pungent ammonia which escapes from the accumulated dung and urine deposited, causing weakness to the eyes, and a fœtid atmosphere most deleterious to his health. (We some years ago had occasion to use a stable for the winter, belonging to a farmer —and he called himself a *good* one—in which he had kept his horses for some months previous. On taking possession of it, we found piles of manure a foot to eighteen inches thick in the rear part of the stalls on which the hind feet of his horses had stood, raising them to that elevation above the fore feet. The

piles steamed with heated ammonia, and so hot that one could hardly bear his hand on them. It is hardly necessary to say that we had them cleared out before using, and on remonstrating with the owner, he listlessly answered, that such was his regular practice *until spring*, and that it was also the general custom of his neighbors. "It was too much work to clean them every day!" Blindness, foot fever, swellings, and "scratches" of course, were frequent occurrences with their horses.)

5th. Let the horses, when worked, be thoroughly rubbed down and cleaned after taking off their harness, well bedded, cooled before they are fed with grain, or watered; and well fed and watered in the morning before put at work.

6th. When worked, they should not be over-driven. If the horse be naturally slow, do not urge him beyond his natural gait, and never match a dull horse with a lively one, or a slow horse with a fast one. They can never work evenly together, and one or the other must suffer from the inequality of gait, draught, and action.

7th. Never overload the team, nor discourage them by a too heavy pull on first starting; nor start from a bad place, but let the load be on a level and hard bottom. A single horse, or a pair, will draw more and easier after getting warmed up to their work, than when first starting. Never draw the check-rein tight in heavy pulling, nor in a fast gait.

8th. Always keep clean wood ashes, pulverized charcoal, salt, rosin, sulphur, epsom or glauber salts at hand, to be administered for slight ailments; and in dosing, when necessary, administer the dose through a cattle horn placed in the mouth, and not by a glass bottle, as the latter may break, and bits of glass get into the throat and stomach of the beast.

Keep, also, liniments of a mild unctuous nature, at hand to apply to bruises, wounds, swelled legs, or other casualties to the flesh or limbs. Carbolic acid is said by chemists to be one of the best, as it is one of the cheapest of the kind.

9th. If horses, when turned to pasture, are inclined to jump fences, or become breachy, have the fences good, and if that will

not secure them, do not put pokes on their necks, but take a leather strap, with a buckle at one end, and holes in the other, (a heavy hame strap will answer the purpose,) and secure a smooth wooden clog of a dozen or twenty pounds weight, according to the size of the horse, to one of the forelegs at the fetlock. Let the end of the clog where the strap is fastened, have a hole for it, and be rounded off. It will not hinder their feeding, but keep them within bounds, and make them easy to catch. In our own practice of many years, we have tried almost all devices, and find this the simplest and most effective.

DISEASES OF HORSES.

When a horse is found ailing, examine him thoroughly, and consult your book—which you should never be without—and if, in your own judgment you can relieve him by a mild dose of medicine, do so, and he will in most cases recover soon, or be relieved, when rest and careful feeding will soon restore him. But if the case be an inflammatory, or violent one, and yourself be not competent to its mastery, *apply at once to an experienced farrier, or veterinarian*, if such an one can be found. There are always, in almost every neighborhood, more or less "horse doctors," empirics, quacks, and pretenders, professing everything, and knowing nothing, in reality, about acute diseases. They more frequently kill than cure, being neither chemists, physiologists, nor intelligent practitioners, in animal diseases. Do not employ them.

After all, ailments and diseases, in a great majority of cases, originate from bad treatment or neglect, and if the rules which we have enumerated are properly regarded, ailments will seldom occur, and then of so trivial kind as to be easily managed. In a forty years' experience with a great many horses, in all kinds of labor, we have never lost but two, and that by violent wind colic, which we traced to gross neglect on the part of our teamsters. Heaves, spavins, blindness, broken wind, and most of the disorders so common with work-horses, can usually be traced to improper usage, neglect, or abuse.

Sometimes infectious or contagious diseases will occur out of the common line, and not always to be guarded against by even pains-taking men; but with proper precaution, even these, in many cases, may be avoided by keeping their animals from contact or exposure with diseased ones. Too much caution cannot be used when such exposures are imminent.

With these general remarks, we dismiss the subject, only repeating the advice to have a good treatise on horse diseases always at hand.

CHAPTER XXIII.

CONCLUSION. GENERAL REMARKS.

In concluding our work, we cannot well let it go to the reader without remarking somewhat on the *business* of agriculture as a permanent occupation, in which the whole mind and ability of the farmer is engaged.

To the successful farmer, it is his only proper occupation—his engrossing business, above all other. By it he earns his living and rears his family. His associations, his interests, and his affections, cluster about his farm, his stock, his crops, his *home*. His social relations, his domestic sympathies are all there. His farm is his little world, and over it he reigns supreme, calling no man master. If his affairs are properly conducted, he is independent—so far as any man can be in civilized society. It is therefore necessary that he attend to his farm, that it be his only, or at all events, chief business and occupation; and that all other concerns in which he may engage, should be secondary, or subsidiary to that.

Look at all the other professions and occupations in life, and see how they are conducted by those who follow them.

The clergyman studies his theology, and labors "in season, and out of season," for the welfare of his people, and the care of their souls.

The lawyer is devoted to his profession, solely; and frequently, through the course of a long and laborious life, knows little outside of it; except, happily, indulging his leisure hours in cultivating the graces of society, or recreating in some chosen path of study or exercises outside, to which his tastes invite him. The physician does the same. The merchant, the manufacturer, the

artisan, the chemist, the miner, pursue the lines of labor embraced in their professions, industriously, studiously, laboriously; and in each they excel and prosper, in proportion to their diligence and intelligence, gaining fame, fortune, or whatever other great object each has striven from the beginning to attain.

The farmer should do likewise. His is not a business to be delegated to others, any more than either of the professions, or the pursuits which we have named; nor can it be thrown off upon clerks and journeymen.

> "He that by the plow would thrive,
> *Himself* must either hold or drive."

In this adage lies a volume of wisdom. The farmer must not only be industrious, but studious. His mind, his thoughts must be in his business. His family must also be industrious and studious. It is true that modern inventions, which have greatly alleviated the labors of not only himself, but his family, have permitted him, and them, much more leisure than their ancestors enjoyed, as well as other pleasures and luxuries; but after all, the farm, the crops, the stock, and household economy, should be his and their chief occupation and delight; and unless that be so, they cannot succeed and prosper. With these properly attended to, success is generally sure. Locality, soil, climate, markets, and some other outside influences may favor one more than another, but in the long run, wherever the farmer fixes his home, success, when his labors are well directed, is almost sure to follow.

As farming is usually pursued, what occupation with no more intelligence and industry applied to it, pays better? Suppose the farmer gets a bare living for himself and family—his farm being paid for—how many men in other occupations can waste, or spare the time, from their regular occupations, that he does, and bring the year about as comfortably and with so little embarrassment? None whatever. Many farmers spend scarcely half their time in steady work on their farms, and still they and their families get through the year comfortably, after their own notions of comfort. Successful men in other pursuits are apt to look on

the farmer's life as one of drudgery, deprivation, hardship. If they understood the farmer's life in all its phases, bearings, and experiences, their conclusions would be widely different.

AMATEUR FARMING.

There is another kind of farming, of which it is proper to speak. It is undertaken as a recreation, an amusement, or a convenience. It is followed, generally, by men who depend for a livelihood upon other pursuits, and their farm labors are delegated to subordinate hands who seldom have the brain, or the application required for the best development of the soil. There is seldom much money profit in it, although there may be much convenience, pleasure, and enjoyment to the proprietor. His knowledge, his perseverance, his persistent attention is given to his own regular business, and not applied to the cultivation of his acres, or the detailed care of his stock. He draws a share of his provisions, food, fruits, and other commodities from his farm, and in their freshness, or superior quality, he derives his enjoyment. He discourses to his friends of his triumphs in cultivation, of his productions, and enjoys at his table and fireside, with them his successes. All this is in the way of luxury, over and above what he can buy in the markets, or obtain from his huckster. He revels in his own products, and takes a hearty pleasure in them. He does not count the cost, and so he obtains what he wants, charges the expense to "profit and loss" in his accounts, and lets the matter go—his enjoyment being a full compensation for the outlay.

Yet, both of these farmers, the one who lives and thrives solely by the cultivation of his land, and the other who cultivates solely for his own pleasure or convenience, should be equally well instructed in the science and principles of their work—the one to make his daily labors profitable and easy; the other to add to his own pleasure, and set a good example to others.

We never yet knew an ignorant man who was a good farmer throughout. Clever, he may be, in many things, and very labo-

rious, but never achieving success in a full round of farm labors, or duties. Truly successful men read, ponder, and understand. They are not great readers of books always, but their minds are on their business, and they are ever ready to seek in books or periodicals for information, where a doubt is to be solved, and they find no readier way to do it. The amateur is always a reader, and his "book farming" is often made a butt of ridicule by many who are utterly ignorant, or know much less of the subject than himself. Every man who turns up a sod in the way of cultivating the earth, should be, more or less, a book farmer.

SUNDRY USEFUL TABLES.

For convenient reference a few tables are given of various *items*, which may much facilitate the farmer in his operations:

ESTIMATE OF FARM SEEDS FOR AN ACRE.

Winter Wheat, broadcast, 1½ to 2 bush.
Winter Wheat, drilled, 1 to 1½ bush.
Spring Wheat, broadcast, 2 to 2½ bush.
Spring Wheat, drilled, 1½ to 2 bush.

The difference between the quantity of winter and spring wheat, is caused by the *tillering* of the winter variety into many stalks in its autumn growth, which the spring sown grain does to a less extent.

Rye, broadcast, 1½ bush.
Rye, drilled, 1 to 1½ bush.
Barley, broadcast, 2 to 2½ bush.
Barley, drilled, 1½ to 2 bush.
Oats, broadcast, 2 to 3 bush.
Oats, drilled, 2 to 2½ bush.
Timothy, (always broadcast,) when sown with grain in the fall of the year, to be followed with clover in the spring, 6 to 8 quarts.
Timothy, without clover, 12 to 16 quarts.
Timothy, sown with clover in the spring, 8 to 10 quarts.
Red Clover, (broadcast,) after timothy in the spring, 4 to 6 quarts.
Red Clover, without other grass, in the spring, 8 to 12 quarts.
Herds, or Red Top, 1 to 1½ bush., of 14 pounds to the bush.
Lucerne, drilled, 10 pounds.
Blue Grass, 1 to 1½ bush., of 14 pounds to the bush.
White Clover, (broadcast,) 8 pounds, usually sown with blue grass.
Indian Corn, in hills, small varieties, 6 to 8 quarts.
Indian Corn, in hills, large varieties, 4 to 6 quarts.
Sorghum, or Chinese Sugar Cane, 2 to 3 quarts.
Millet, broadcast, ¾ to 1 bush.
Buckwheat, ¾ to 1 bush.
Beets and Mangold Wurtzel, 4 to 6 pounds.
Carrots, 2 to 3 pounds.
Turnips and Rutabagas, 1 pound.
Parsnips, 4 to 6 pounds.
Beans, in drills 2½ feet apart, 1½ bush.
Potatoes, in drills, 10 to 12 bush.
Potatoes, in hills, 8 to 10 bush.

As a general rule, rich soil requires one-fourth to one-third *less* seed per acre than thin, or light soils, as the plants grow stouter on rich than on poor ground.

NUMBER OF PLANTS ON AN ACRE.

The following table shows the number of plants or trees, at the distances named apart, which may be planted on an acre.

Distances apart.	No. of Plants.	Distances apart.	No. of Plants.
1 foot by 1 foot, ...	43,560	6½ feet by 6½ feet, . . .	1,031
1½ " " 1½ "	19,360	7 " " 7 "	888
2 feet " 1 "	21,780	8 " " 8 "	680
2 " " 2 feet, ...	10,890	9 " " 9 "	537
2½ " " 2½ " . . .	6,969	10 " " 10 "	435
3 " " 1 "	14,520	11 " " 11 "	360
3 " " 2 "	7,260	12 " " 12 "	302
3 " " 3 "	4,840	13 " " 13 "	257
3½ " " 3½ "	3,555	14 " " 14 "	222
4 " " 1 "	10,890	15 " " 15 "	193
4 " " 2 "	5,445	16 " " 16 "	170
4 " " 3 "	3,630	17 " " 17 "	150
4 " " 4 "	2,722	18 " " 18 "	134
4½ " " 4½ "	2,151	19 " " 19 "	120
5 " " 1 "	9,712	20 " " 20 "	108
5 " " 2 "	4,356	25 " " 25 "	69
5 " " 3 "	2,904	30 " " 30 "	48
5 " " 4 "	2,179	40 " " 40 "	27
5 " " 5 "	1,742	50 " " 50 "	17
5½ " " 5½ "	1,417	60 " " 60 "	12
6 " " 6 "	1,210	66 " " 66 "	10

For intermediate spaces in the above numbers, one can readily add, subtract, divide or multiply, as he may wish.

VALUE OF FOOD FOR DOMESTIC ANIMALS.

The figures below give the comparative number of pounds of each substance to equal in effect that of any standard food—as, for instance, that of hay.

Good Hay, to give a certain nourishment, requires . . .	100 pounds.
Good Clover Hay will give same effect by the use of . .	95 "
Rye Straw " " " . . .	355 "
Oat Straw " " " . . .	220 "
Potatoes " " " . . .	195 "
Carrots " " " . . .	280 "
Beets " " " . . .	346 "
Ruta Bagas " " " . . .	262 "

Wheat will give same effect by the use of			. . .	43 pounds.
Peas	"	"	" . . .	44 "
Beans	"	"	" . . .	46 "
Rye	"	"	" . . .	49 "
Barley	"	"	" . . .	51 "
Indian Corn	"	"	" . . .	56 "
Oats	"	"	" . . .	59 "
Buckwheat	"	"	" . . .	64 "
Oil Cake	"	"	" . . .	64 "

CONSUMPTION OF HAY.

The hay consumed by different animals does not vary greatly from *three* pounds daily for each hundred pounds weight of the animals. The following table is the result of various experiments by different persons, and will be useful for farmers who wish to determine, by calculation beforehand, how their hay will hold out for the winter; 500 cubic feet of timothy hay, in a full bay, being about one ton:

Working Horses,	3.08 pounds.	Steers,	2.84 pounds.
Working Oxen,	2.40 "	Dry Cows,	2.42 "
Milk Cows, (Boussingault's)	2.25 "	Pigs, (estimated)	3.00 "
Milk Cows, (Lincoln's)	2.40 "	Sheep,	3.00 "
Young Growing Cattle,	3.08 "		

All the articles enumerated in these food tables are estimated as of good quality. If the fodder be of poor quality, more must be allowed.

WEIGHT OF A CUBIC FOOT

of various substances, from which the bulk of a load of one ton may be easily calculated:

Cast Iron, ...	450 pounds.	Common Soil, compact, about	124 pounds.
Water, ...	62 "	Clay, "	135 "
White Pine, seasoned, about	30 "	Clay, with stones, "	160 "
White Oak, " "	52 "	Brick, "	125 "
Loose Earth, "	95 "	Stone, "	170 "

BULK OF A TON OF DIFFERENT SUBSTANCES.

23 cubic feet of Sand make about a ton.
18 cubic feet of Earth make about a ton.
17 cubic feet of Clay make about a ton.

18 cubic feet of gravel or earth, before digging, make 27 cubic feet when dug; or, the bulk is increased as three to two.

TO MEASURE GRAIN IN THE GRANARY.

Divide the cubic feet by 56, and multiply by 45, and the result will be struck measure in bushels.

TO MEASURE CORN IN THE CRIB.

Multiply the length, breadth, and height together, in feet, to obtain the cubic feet; multiply this product by 4, and strike off the right figure; and the result will be shelled bushels, nearly.

UNITED STATES BUSHEL AND GALLON.

The United States bushel, adopted now by the State of New York, is 2150.40 cubic inches. The gallon 231 cubic inches. The dry measure gallon, or one-eighth of the bushel, is 268.8 cubic inches.

WEIGHT OF GRAIN.

The laws of this State established the following weights, avoirdupois, to the bushel of the articles named, in the absence of a specific contract:

	Pounds.		Pounds.
Wheat,	60	Timothy Seed,	44
Indian Corn,	56	Clover Seed,	60
Rye,	56	Flaxseed,	56
Buckwheat,	48	Potatoes,	60
Barley,	48	Dried Apples,	22
Oats,	32	Dried Peaches,	32
Beans,	62	Salt,	56
Peas,	60	Onions,	57

CAPACITY OF SOILS FOR WATER.

The following substances are saturated when they contain, of their own weight,

Sand,	about	24	per cent.	of water.
Calcareous Sand,	"	28	"	"
Loamy Soil,	"	33	"	"
Clay Loam,	"	47	"	"
Peat,	"	80	"	"

VELOCITY OF WATER IN TILE DRAINS.

An acre of land in a wet time contains about 1,000 spare hogsheads of water. An underdrain will carry off the water from a strip of land about 2 rods wide, and one 80 rods long will drain an acre.

The following table will show the size of the tile required to drain an acre in two days' time (the longest admissible) at different rates of descent, or the size for any larger area:

Diameter of Bore.	Rate of Descent.	Velocity of current per second.	Hogsheads discharged in 24 hours.
2 inches,	1 foot in 100	22 inches,	400
2 "	1 " 50	32 "	560
2 "	1 " 20	51 "	900
2 "	1 " 10	73 "	1,290
3 "	1 " 100	27 "	1,170
3 "	1 " 50	38 "	1,640
3 "	1 " 20	67 "	3,100
3 "	1 " 10	84 "	3,600
4 "	1 " 100	32 "	2,500
4 "	1 " 50	45 "	3,500
4 "	1 " 20	72 "	5,600
4 "	1 " 10	100 "	7,800

A deduction of one-third to one-half must be made for the roughness of the tile or imperfection in laying. The drain must be of some length to give the water velocity, and these numbers do not therefore apply to very short drains.

CONTENTS OF CISTERNS.

The following gives the contents of circular cisterns for each foot in depth:

	Barrels.		Barrels.
5 feet diameter,	4.66	8 feet diameter,	11.93
6 " "	6.71	9 " "	15.10
7 " "	9.13	10 " "	18.65

FORCE OF WIND.

The force exerted by windmills will vary greatly with the velocity of the wind. The following table shows the pressure against a fixed surface; from the velocity given in this table, the average velocity of the sails must be deducted, and the remainder will show the real force exerted:

Velocity. Miles ar hour.	Pressure in lbs. on square ft.	Description
1	.005	Hardly perceptible.
2	.020	Just perceptible.
3	.045	
4	.089	Light breeze.
5	.125	
6	.180	Gentle, pleasant wind.
7	.320	
10	.500	Pleasant, brisk wind.
15	1.125	
20	2.000	Very brisk.
25	3.125	
30	4.500	Strong, high wind
35	6.125	
40	8.000	Very high.
45	10.125	
50	12.500	Storm or tempest.
60	18.000	Great storm.
80	32.000	Hurricane.
100	50.000	Tornado, tearing up trees and sweeping off buildings.

VALUE OF DIFFERENT KINDS OF WOOD AS FUEL.

The celebrated experiments of Marcus Bull, of Philadelphia, many years ago gave the following results, showing the amount required to throw out a given quantity of heat:

Hickory,	4 cords.	Pitch Pine,	9 1-7 cords.
White Oak,	4 3-4 "	White,	9 1-5 "
Hard Maple,	6 2-3 "	Anthracite Coal,	4 tons.
Soft Maple,	7 1-5 "	Bituminous Coal,	5 "

TEMPERATURE FOR THE RISING OF CREAM.

The temperature of the surrounding air has a great effect upon the time required for the rising of the cream. Experiment has demonstrated that, with the thermometer at

80 deg.,	all the cream will rise in	10 hours.			55 deg.,	all the cream will rise in	24 hours.		
77 "	" "	12 "			50 "	" "	36 "		
68 "	" "	18 "			45 "	" "	43 "		

WEIGHT OF HAY IN CUBIC MEASURE.

According as it is packed, in large or small quantities, and the pressure on the top, hay will weigh a ton to 400, 500, and even 600 cubic feet of measurement, either in mows in barns, or stacks

outside, after lying two, three, or more months. The weight, per measure, will also depend somewhat on the condition in which it is put up. Late cut and *woody* hay will weigh less than that which is cut green and in good season, as the latter packs closer than the other. Also fine hay, as red-top, blue-grass, white clover, and rowen, which packs very close, will weigh much heavier to the same bulk than timothy, red clover, orchard grass, &c.

AVERAGE COMPOSITION, PER CENT. AND PER TON, OF VARIOUS KINDS OF AGRICULTURAL PRODUCE, ETC.

	PER CENT.					LBS. PER (LONG) TON.					Value of manure in dollars and cents from 1 ton (2000 lbs) of food.
	Total dry matter.	Total mineral matter (ash).	Phosphoric acid reckoned as phosphate of lime.	Potash.	Nitrogen.	Total dry matter.	Total mineral matter (ash).	Phosphoric acid reckoned as phosphate of lime.	Potash.	Nitrogen.	
1. Linseed cake.........	88.0	7.00	4.92	1.65	4.75	1,971	156.8	110.2	37.0	106.4	19.72
2. Cotton seed cake.....	89.0	8.00	7.00	3.12	6.50	1,994	179.2	156.8	70.0	145.6	27.86
3. Rape cake.......... ..	89.0	8.00	5.75	1.76	5.00	1,994	179.2	128.8	39.4	112.0	21.01
4. Linseed...............	90.0	4.00	3.38	1.37	3.80	2,016	89.6	75.7	30.7	85.1	15.65
5. Beans.................	84.0	3.00	2.20	1.27	4.00	1,882	67.2	49.3	28.4	89.6	15.75
6. Peas..................	84.5	2.40	1.84	0.96	3.40	1,893	53.8	41.2	21.5	76.2	13.38
7. Tares.................	84.0	2.00	1.63	0.66	4.20	1,892	44.8	36.5	14.8	94.1	16.75
8. Lentils...............	88.0	3.00	1.89	0.96	4.30	1,971	67.2	42.3	21.5	96.3	16.54
9. Malt dust.............	94.0	8.50	5.23	2.12	4.20	2,106	190.4	117.1	47.5	94.1	18.21
10. Locust beans.........	85.0	1.75	....	....	1.25	1,904	39.2	.....	....	28.0	4.81
11. Indian meal..........	88.0	1.30	1.13	0.35	1.80	1,971	29.1	25.3	7.8	40.3	6.65
12. Wheat................	85.0	1.70	1.87	0.50	1.80	1,904	38.1	42.0	11.2	40.3	7.08
13. Barley...............	84.0	2.20	1.35	0.55	1.65	1,882	49.3	30.2	12.3	37.0	6.32
14. Malt.................	95.0	2.60	1.60	0.65	1.70	2,128	58.2	35.8	14.6	38.1	6.65
15. Oats.................	86.0	2.85	1.17	0.50	2.00	1,926	63.8	26.2	11.2	44.8	7.70
16. Fine pollard*........	86.0	5.60	6.44	1.46	2.60	1,926	125.4	144.2	32.7	58.2	13.53
17. Coarse pollard †......	86.0	6.20	7.52	1.49	2.58	1,926	138.9	168.4	33.4	57.8	14.36
18. Wheat bran..........	86.0	6.60	7.95	1.45	2.55	1,926	147.8	178.1	32.5	57.1	14.59
19. Clover hay...........	84.0	7.50	1.25	1.30	2.50	1,882	168.0	28.0	29.1	56.0	9.64
20. Meadow hay..........	84.0	6.00	0.88	1.50	1.50	1,882	134.4	19.7	33.6	33.6	6.43
21. Bean straw...........	82.5	5.55	0.90	1.11	0.90	1,848	124.3	20.2	24.9	20.2	3.87
22. Pea straw............	82.0	5.95	0.85	0.89	....	1,837	133.3	19.0	19.9	20.2	3.74
23. Wheat straw.........	84.0	5.00	0.55	0.65	0.60	1,882	112.0	12.3	14.6	13.4	2.68
24. Barley straw..........	85.0	4.50	0.37	0.63	0.50	1,904	100.8	8.3	14.1	11.2	2.25
25. Oat straw............	83.0	5.50	0.48	0.93	0.60	1,859	123.2	10.7	20.8	13.4	2.90
26. Mangold wurtzel.....	12.5	1.00	0.09	0.25	0.25	280	22.4	2.0	5.6	5.6	1.07
27. Swedish turnips......	11.0	.68	0.13	0.18	0.22	246	13.4	2.9	4.0	4.6	91
28. Common turnips......	8.0	.68	0.11	0.29	0.18	179	15.2	2.5	6.5	4.0	86
29. Potatoes.............	24.0	1.00	0.32	0.43	0.35	537	22.4	7.2	9.6	7.8	1.50
30. Carrots..............	13.5	.70	0.13	0.23	0.20	302	15.7	2.9	5.1	4.5	86
31. Parsnips.............	15.0	1.00	0.42	0.36	0.22	336	22.4	9.4	8.1	4.9	1.14

* Middlings, Canielle. † Shipstuff.

The foregoing table, showing the composition of various foods and the estimated value of the manure made by animals consuming a ton of them, was prepared by John B. Lawes, of Rothamstead. The composition of the foods is undoubtedly correct; the estimated money value must be taken only relatively. The figures given are in *gold*, and are based on English prices of guano and other commercial manures. New York prices are from one-quarter to one-third higher.

It will be seen that cotton seed cake makes the richest manure of any food in the list. Linseed oil-cake, peas, beans, malt dust, and bran, are among the most valuable foods. Coarse bran is frequently sold at a price that would make it, after deducting the value of the manure, one of the most profitable foods to purchase. Clover hay stands high in the list.

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